

# Grade 3

## Matter and Magnetism



In this learning experience, students experience and describe matter by observing its **properties**, such as hardness, color, smell, shape, state, and magnetism. The process of observing properties of matter directly and indirectly begins with manipulating Mystery Film cans to try to determine what objects they contain, and how they can be classified. Students then experience matter in three states to help them form their own operational definitions of solids, liquids, and gases.

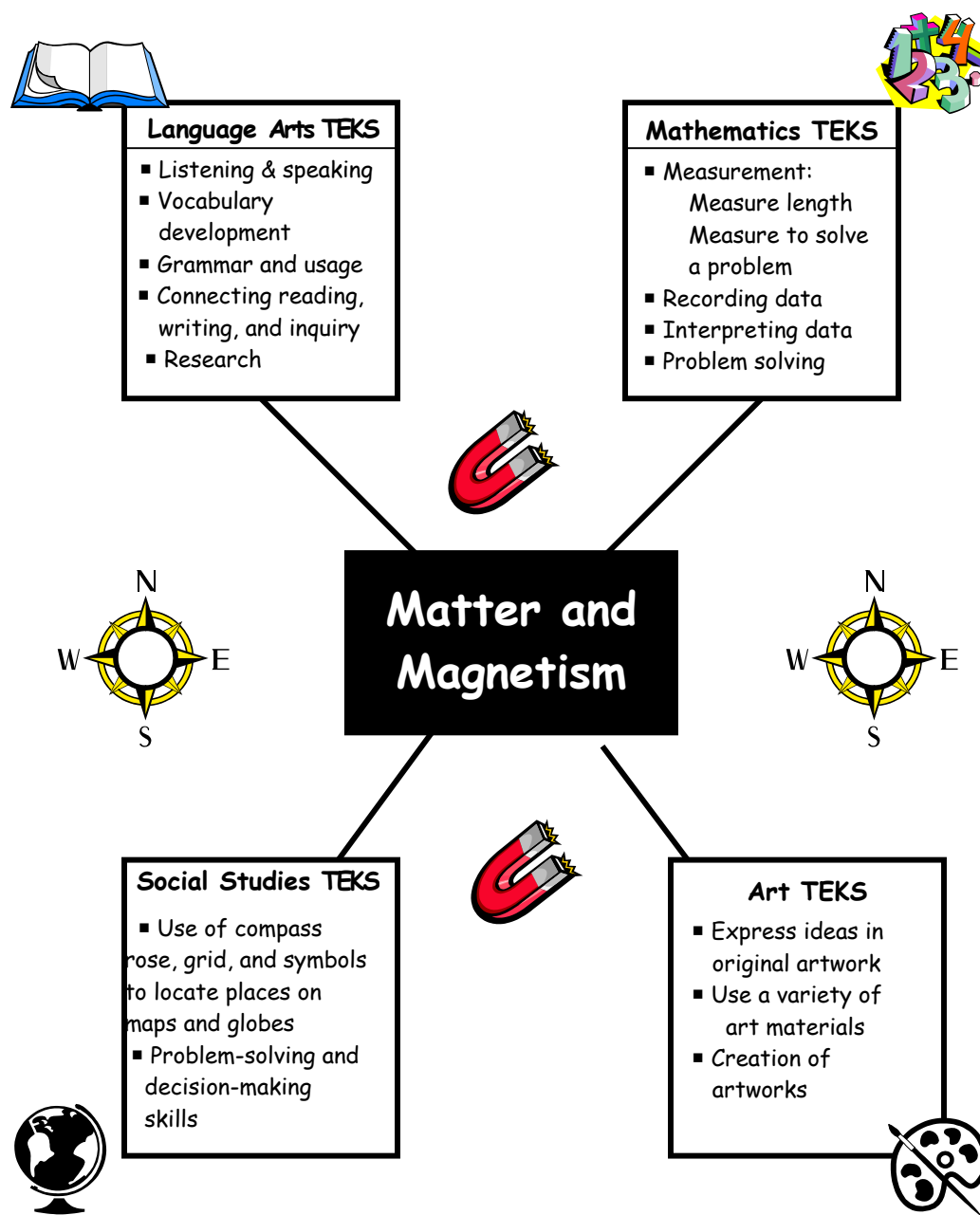
As students observe the properties of magnets, they begin to understand that magnetism is a property that reveals itself only when a magnet is interacting with certain materials. Students learn that they can't actually see magnetism, but they can see what happens when a magnet is placed near different materials, and experience the invisible forces that can pull objects closer together or push them apart.

## Table of Contents

	page
♦ <b>Interdisciplinary Connections</b> Language Arts, Mathematics, Social Studies, Art	<b>1</b>
♦ <b>Overview of Learning Experiences</b> Targeted Science TEKS, Engage, Explore, Explain, Elaborate, Evaluate	<b>2</b>
♦ <b>Engage</b> Students describe properties of objects that are observed directly and indirectly.	<b>3</b>
♦ <b>Explore</b> Students manipulate film cans to discover and classify hidden objects.	<b>9</b>
♦ <b>Explain</b> Students communicate their findings from the explore activity, and form operational definitions of matter in three states	<b>12</b>
♦ <b>Elaborate</b> Students experience the invisible forces magnets and make a compass	<b>27</b>
♦ <b>Evaluate</b> Students demonstrate their understanding of the matter and magnetism	<b>45</b>
♦ <b>Materials Details Sheet</b> List and description of items required for each section of the learning experience	<b>51</b>
♦ <b>Background Information for Teachers</b> General summary of content information for teachers	<b>58</b>
♦ <b>Content Area TEKS</b> Texas Essential Knowledge and Skills statements for each of the content areas addressed in this learning experience	<b>61</b>
♦ <b>Reading Connections</b> List of suggested books and stories for students about matter and magnetism	<b>66</b>
♦ <b>References</b> List of books, articles, and websites used by developers of this learning experience	<b>67</b>
♦ <b>Master Copies of Student Materials</b> Student sheets and other materials to be copied by teacher when using this learning experiences in the classroom	<b>A-Z</b>

## Interdisciplinary Connections

See pages 61-65 for complete wording of the Texas Essential Knowledge & Skills for each content area addressed in this learning experience.



**Matter and Magnetism****Teaching Guide****Grade 3****Overview of Learning Experiences**

<b>TEKS</b>	<p><b>3.4</b> The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:</p> <p>(A) <b>collect and analyze information using tools</b> including calculators, microscopes, cameras, <b>safety goggles</b>, sound recorders, <b>clocks</b>, computers, <b>thermometers</b>, <b>hand lenses</b>, meter sticks, rulers, <b>balances</b>, <b>magnets</b>, and <b>compasses</b></p> <p><b>3.7</b> The student knows that matter has physical properties. The student is expected to: (A) gather information including <b>temperature</b>, <b>magnetism</b>, <b>hardness</b>, and <b>mass</b> using appropriate tools to identify physical properties of matter</p>
<b>Engage</b>	<ul style="list-style-type: none"> <li>◆ Students review properties by playing The Property Game.</li> <li>◆ Students observe closed film cans, and predict the material inside.</li> <li>◆ Students classify materials in closed film cans, based on properties.</li> </ul>
<b>Explore</b>	<ul style="list-style-type: none"> <li>◆ Students pour out the contents of the film cans, and to observe properties of materials, including shape, size, mass, and amount of space.</li> <li>◆ Students explore properties of solids, liquids, and gases at stations.</li> </ul>
<b>Explain</b>	<ul style="list-style-type: none"> <li>◆ Students explain observations of the properties of solid, liquid, and gaseous matter, based on the results of film can tests and Explore Stations.</li> <li>◆ Students explain the "rules" of behavior for solids, liquids, and gases.</li> </ul>
<b>Elaborate</b>	<ul style="list-style-type: none"> <li>◆ Students observe and make predictions about a flying paper clip.</li> <li>◆ Students observe the properties of magnets at stations, including magnetic attraction, polarity, strength, and interactions with a compass.</li> <li>◆ Students generalize about the "rules" of magnet behavior on the Tools concept map as a pre-reading strategy.</li> <li>◆ Students read <i>What Makes a Magnet?</i> and add more details to the Tools concept map.</li> <li>◆ Students make a compass from a magnetized needle, water, and cork.</li> <li>◆ Students choose magnets for a magnet relay race.</li> <li>◆ Students design a magnet puppet show to dramatize the book.</li> </ul>
<b>Evaluate</b>	<ul style="list-style-type: none"> <li>◆ Students complete assessment on matter and magnetism.</li> <li>◆ Students complete performance task to test if magnets can attract objects through solids, liquids, or gases.</li> </ul>

# ENGAGE

## A. THE PROPERTY GAME

1. Place a two index cards, a double pan balance and centimeter ruler on each group's table.
2. Tell the class they are going to play The Property Game. Explain that you will give each group a bag that contains a secret object. Each group will have one minute to list describing words about the properties or characteristics of the secret object on one of the 3x5 cards, without naming the object. The property descriptions must be clear so the other students will be able to guess the object in the bag.
3. Ask each group to tell about the properties of the secret object before other groups begin guessing. Allow the other groups to confer with each other before writing one guess about objects A-O on the group's 3x5 guessing card. Ask each group to make a guess about each object. After all groups have completed a guessing card, ask each group to take their object out of the bag and hold it up so everyone can see it. Discuss the **properties** listed by each group, and ask other groups to tell which characteristics or properties helped them the most to predict what was in the bag.
4. Review that a **property** is a characteristic of an object that we can detect using senses or tools, such as color, shape, size, mass, texture. The careful communication of an object's properties should give a clear mental picture of the object, even if it is hidden from view. Encourage the use tools by reminding students that properties of objects can be measured. They will have more opportunities to describe properties of hidden objects in Explore.

**Materials** (details p. 51)

**For each group:**

A paper bag containing a secret object, which is labeled with a letter A-R

- ☐ A square wooden block
- ☐ B water balloon
- ☐ C air-filled balloon
- ☐ D toy truck
- ☐ E steel ball
- ☐ F wooden ball
- ☐ G cotton ball
- ☐ H large marble
- ☐ I yo-yo
- ☐ J light up shoe
- ☐ K sharpener
- ☐ L cylinder block
- ☐ M sand- filled balloon
- ☐ N bean bag animal
- ☐ O flashlight

*"Concrete perceptions must come before abstract explanations. Students need to become familiar with the physical and chemical properties of many different kinds of materials through first hand experience before they can be expected to consider theories that explain them."*

*Benchmarks for Science Literacy, p. 75*

## B. Mystery Film Cans

1. Prepare a set of numbered film cans for each group, and set them in the plastic tray.

2. Assign each member of the group a cooperative learning role. Discuss the responsibilities of each role or job.

- Principal Investigator- in charge of leading the investigation, and making sure the film cans remain closed during predictions
- Materials Manager-gathers and returns testing materials
- Safety Technician- makes sure safety rules are followed
- Reader/Recorder- reads directions and records group information.

3. Ask Materials Managers to pick up the film can trays.

4. Review how to find the mass of an object on a double pan balance, using gram stackers and an empty film can. Note that the film cans are of the same type, and have the same mass of 5 grams when they are empty. Introduce that if a material is massed in a container, the mass of the container must be subtracted from the total mass measurement. For this grade level, using the same kind and type of film container will prevent them from having to mass the film can separately each time.

5. Instruct the groups to observe the **closed** film cans and describe their **properties**. Students may observe that the cans have a cylinder shape, and have smooth surfaces or textures. They also seem to have different masses, which is a clue that the materials inside might be different from each other. Encourage students to discover more about what might be inside the cans, **without** opening the cans. One way might be shaking each can near their ear. Each group should find other

**Materials** (details p. 51)

**For each group:**

Set of numbered film cans, containing:

- ☐ 1- marble
- ☐ 2- steel ball
- ☐ 3- paper clips
- ☐ 4- ring magnets
- ☐ 5- sand
- ☐ 6- water
- ☐ 7- air (empty, but spray inside of can with perfume))
- ☐ 8- cotton ball
- ☐ plastic tray
- ☐ double pan balance
- ☐ centimeter ruler
- ☐ Mystery Can student data sheets or student journals
- ☐ laminated Three Groups of Materials student sorting page

**Matter and Magnetism****Teaching Guide****Grade 3****ENGAGE**

ways to discover clues about the material each film can contains. Remind students that tools are needed to discover some properties of the objects.

6. Each student should record observations by writing a property description for the materials in each film can on the Closed Mystery Can student data sheet.

7. Ask students to classify the cans into three groups, based on similar properties of the materials they contain. Students may use the sorting circle data sheet, or construct one in their science journal to record the numbers of the cans they placed in each group, and a description of their common group properties.

**Questioning Strategies**

- What properties of the material in Can 1 can be observed without opening it? *(It rolls from one end of the can to the other when the can is shaken, makes a soft thud sound when it hits the end or side, and has a mass of 25 grams.)*
- What clues helped you make a prediction about the object? *(It must be round, because it rolls. It must be hard, because it thuds when it hits the end.)*
- What are the observable properties of the mystery material in Can 2? Can you make a prediction about what it is, based on your observations? *(It rolls from one end of the can to the other when the can is shaken, makes a loud thud sound when it hits the end or side, and has a mass of 79 grams. It might also be a hard round object, because it rolls. It makes a different sound and has much more mass, so it might be made of a different material.)*
- What are the observable properties of the mystery material in Can 3? Can you make a prediction about the object, based on your

*Over the school years, students should study and manipulate (shape, cut, drill, pound, bake, soak, radiate, join, grind, etc.) many different kinds of **materials**, from mud, clay, and paper to chemical reagents, alloys, and plastics.*

*Benchmarks for  
Science Literacy, p.187*

observations? *(It slides from one end of the can to the other when shaken, and makes several clinking sounds when it hits the ends. It is not round, because it slides. It has a mass of 9 grams.)*

- What are the observable properties of the mystery material in Can 4? *(It slides from one end of the can to the other when shaken, and makes a thud sound when it hits the ends, and has a mass of 71 grams. It seems to stick to Can 3 if they are placed close together.)*
- What are the observable properties of the material in Can 5? *(It moves from one end of the can to the other when shaken, and piles up at the lowest end of the can. It has a mass of 17 grams.)*
- What are the observable properties of the mystery material in Can 6? *(It sounds like it is sloshing back and forth when the can is shaken, and has a mass of 25 grams. It could be water.)*
- What are the observable properties of the mystery material in Can 7? *(It makes no sound when shaken, and feels like it might be empty. It has a mass of 6 grams.)*
- What are the observable properties of the mystery material in Can 8? *(It makes no sound when shaken, and also feels like it might be empty. It has a mass of 8 grams.)*
- Do all of the materials take up some space in the cans? How do you know? *(The materials in cans 1, 2, 3, 4, 5 and 6 moved around in the space, so we could hear it. It was hard to tell with Cans 7 and 8.)*
- How did you classify your cans into three groups on the sorting sheet?
- What **properties** did you use to classify the cans?

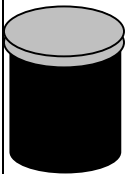
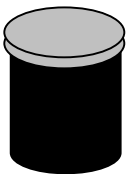
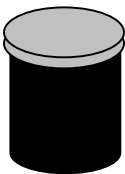
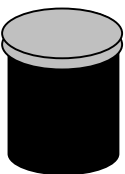
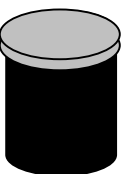


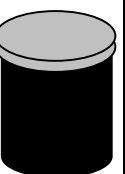
*Students should measure, estimate, and calculate sizes, capacities, and weights. If young children can't feel the weight of something, they may believe it to have no weight at all. Many experiences of weighing (if possible, on increasingly sensitive balances) - including weighing piles of small things and dividing to find the weight of each - will help.*

*Benchmarks for Science Literacy, p. 76*



**Matter and Magnetism****Teaching Guide****Grade 3****Closed Mystery Cans**

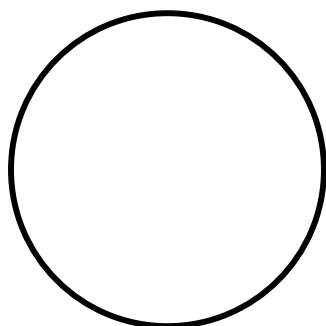
Observe the **closed** cans and record as many properties of the materials from each can in the correct column. Predict what each can might contain, and write it in the box below each numbered can.

	1	2	3	4	5	6	7	8
Property								
Mass In Grams								
Slides								
Rattles								
Sloshes								
Rolls								
Silent								
I predict the object in the can is								

**Three Groups of Materials in Closed Cans**

Classify the film cans into three groups. Write the numbers of the film cans that are grouped together in each circle. List the **properties** you used to classify the members of each group on the lines next to the circle.

Group 1



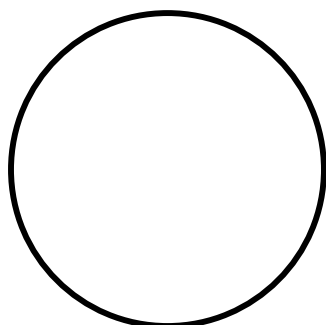
Properties

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Group 2



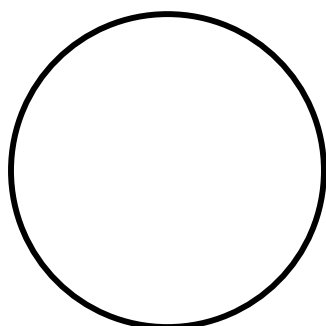
Properties

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Group 3



Properties

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## Open Mystery Cans

1. Instruct groups to open each can and empty its contents onto the tray. After each can is emptied, students record their observations on the Mystery Can Materials student data sheet, and replace the materials in each film can before opening the next can.

2. Ask students to classify the cans into three groups again, based on similar visible properties of the materials they contain, using the sorting circle data sheet. These will be used during the Explain section.

**Materials** (details p. 52)

**For each group:**

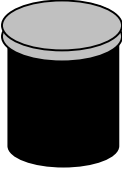
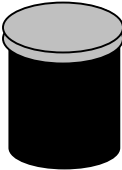
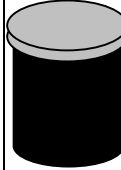
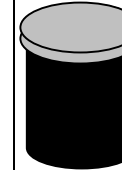
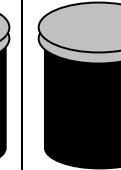
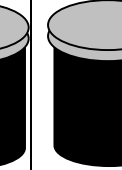
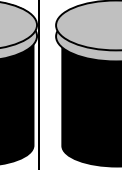
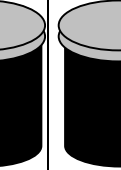
Set of numbered film cans, containing:

- ☐ 1- marble
- ☐ 2- steel ball
- ☐ 3- paper clips
- ☐ 4- ring magnets
- ☐ 5- sand
- ☐ 6- water
- ☐ 7- air (empty, but spray inside of can with perfume)
- ☐ 8- cotton ball
  
- ☐ plastic tray
- ☐ double pan balance
- ☐ centimeter ruler
  
- ☐ Open Mystery Can student data sheets or student journals
- ☐ laminated Three Groups of Materials in Open Cans student sorting page

**EXPLORE**

**Matter and Magnetism****Teaching Guide****Grade 3****Open Mystery Cans**

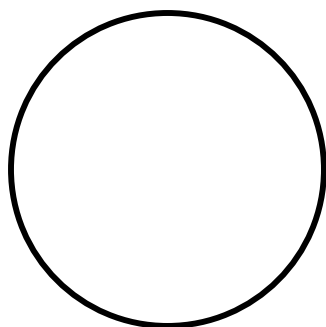
Pour the material in each can onto the tray. Record the properties of the materials from each can in the correct column. Write the name of the object in the box under each can. Were your predictions correct?

Property	1	2	3	4	5	6	7	8
								
Piles up								
Shape								
Color								
Texture								
Mass								
Hardness								
Rolls								
Slides								
Piles up								
Flows								
Spread out								
Object								

### Three Groups of Materials in Open Cans

Write the numbers of the film cans that are grouped together in each circle. List the **properties** you used to classify the members of each group on the lines next to the circle. Did your classification change?

Group 1



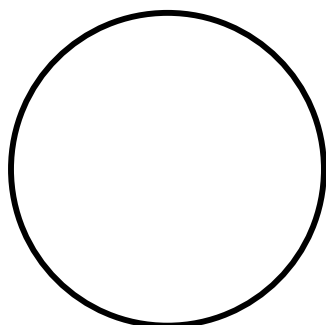
Properties

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Group 2



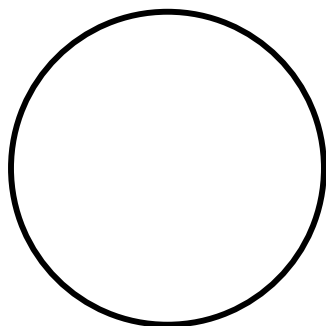
Properties

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Group 3



Properties

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## EXPLAIN

### A. OPEN MYSTERY CANS

1. Students will need the film cans and data sheets from Engage and Explore to use during their explanations.
2. Ask each group to explain how they classified the materials in the open film cans, and the properties they used to classify them.

#### Questioning Strategies

- Did your group's classification system change after opening the cans and discovering more properties of the objects?
- What were some of the different properties of the materials you were able to observe? (Color, shape, texture, size)
- What did the materials in Cans 1 and 2 do when you poured them into the tray? (They rolled because they were round.)
- Did they change shape when they changed containers? (No, they both stayed round.)
- What did the materials in Can 3 do when it was poured into the tray? (*The paper clips slid out, and piled up.*)
- Did the paper clips change shape when they changed containers? (*No, they still have a paper clip shape.*)
- What did the materials in Can 4 do when it was poured into the tray? (*The rings slid out, rolled, and did not change shape. They all stuck together. They may be magnets.*)
- Do all of the materials you observed take up space? How do you know? (*Yes, they all took up space in the film can and on the tray.*)

#### Materials (details p. 52)

##### For each group:

##### OPEN MYSTERY CANS

- ❑ Set of 8 numbered film cans from Explore
- ❑ plastic tray
- ❑ double pan balance
- ❑ centimeter ruler
- ❑ Mystery Can student data sheets
- ❑ Three Groups of Materials data sheet

##### 1. Station 1: Soft Shapes

- ❑ Play dough
- ❑ Play dough container
- ❑ tray
- ❑ student journal

## EXPLAIN

**Matter and Magnetism****Teaching Guide****Grade 3**

- Do all of the materials you observed have mass? How do you know? *(Yes, because we found the mass of each one on the balance.)*
- Did any of the other cans contain materials that did not change shape when poured from the film can to the tray? *(The cotton ball fell out of the Can 7, and plopped on the tray. It stayed the same shape.)*
- What is another word for materials that keep their shape when they are moved from one container to another? **(Solids)**
- What did the material in Can 5 do when it was poured onto the tray? *(The sand poured out, and then piled up.)*
- What did the material in Can 6 do when it was poured into the tray? *(We poured it out, and the water flowed and spread out all over the tray.)*
- Did it stay the same shape? *(No, it spread out until it was the shape of the tray.)*
- What might have happened if you poured it on the table? *(It might have spread out over the table, just like a spilled glass of milk.)*
- What other materials might flow and spread out if they were poured in the tray? *(Juice, soda, lemonade)*
- What is another name for materials like water and juice that flow? **(Liquids)**

5. Ask students to investigate more properties of solid and liquid materials at the Soft Shapes, Tip It, Turn It, and All Bottled Up, and the Comparing Sand and Water stations.

6. Ask students to investigate by using the materials and instruction card at each station, and keep careful records of observations from each station in their student journals.

**Materials (details p.52 )****For each group:****Station 2. Tip It, Turn It**

- ☐ bottles with lids
- ☐ water

**Station 3 All Bottled Up**

- ☐ 4 bottles with lids marked and filled with:
  - ☐ A colored water
  - ☐ B corn syrup
  - ☐ C mineral oil
  - ☐ D dishwashing soap

**Station 4 Comparing Sand and Water**

- ☐ 4 clear plastic cups
- ☐ sand
- ☐ water
- ☐ tray

**EXPLAIN**

- What happened at Station 1 when you moved the play dough from the container to the tray? What do we call materials that keep their shape when moved from container to container? (*The play dough kept its shape, so it must be a solid material.*)
- How are the marble and the play dough alike? (*They are both solid materials.*)
- How are the marble and the play dough different? (*Play dough is a softer solid, and can be reshaped more easily than a marble.*)
- Describe how the water surface looked as the bottle was slowly tipped sideways and upside down in Station 2. (*Record their descriptions on an overhead diagram of the bottles.*)
- How did the materials in the Station 3 bottles behave? (*They flowed to take the shape of each part of the bottle as they were tipped sideways and upside down, so they must be liquids.*)
- Did they all flow the same way, and at the same speed? (*The liquid in Bottle A flowed like water, but the liquid in Bottle B flowed very slowly in the bottle.*)
- At Station 4, what properties of sand and water were similar? (Both sand and water could be poured.)
- What properties of the sand and water were different? (Sand piled up and had an uneven surface when it was poured, but water had a level surface and spread out to take the shape of the container. The penny stayed on the sand's surface, but sank in water. Sand could be piled up in rows on a tray or paper towel, but water flowed and spread out.)

**Materials** (details p. 53)**For each group:****Station 4. Does Air Take Up Space?**

- ☐ perfume
- ☐ envelope
- ☐ quart-size baggie
- ☐ clear plastic cup,
- ☐ paper towel
- ☐ tape
- ☐ bucket of water

**Station 5. Does Air Have Mass?**

- ☐ tape
- ☐ binder clips
- ☐ plastic bags
- ☐ ruler
- ☐ flexible straw
- ☐ 3 pieces of string
- ☐ Set of States of Matter Property Cards



- What did the material in Can 8 do when it was poured into the tray? *(Nothing, because it was empty except for air.)*
- Could you see anything when you tried to pour it in the tray? *(No, we can't see air.)*
- Did you smell anything when you opened the can? *(It smelled like perfume when we first opened it, then the smell faded.)*
- Where did the air go if when you let it out of the can? *(It could have gone out with the rest of the air in the room.)*
- What could we do to mark the air so we could find out where it goes? *(We could spray it with something that has an odor, like perfume or room spray.)\**
- Does the air in the can have properties that are similar to the materials in the other cans? How can we find out?

\*To demonstrate "marking air", spray some perfume from a corner of the room, then ask people who are in different parts of the room to raise their hand when they smell it.

7. To find out other properties of air, demonstrate or create a center for students to experience Does Air Take Up Space? and Does Air Have Mass?

- Did the plastic bag in Station 5 fit back into the envelope after it was blown up? *(No, because the air filled up all of the space in the bag, and it wouldn't fit in the envelope.)*
- Describe what happened in Station 6, when the cup with the paper towel attached was pushed straight to the bottom. *(The paper towel stayed dry because the air took up space in the cup, and wouldn't let water come in. This shows that air takes up space.)*
- Were the results the same in Station 6 when the cup was tilted sideways? *(No, because the air could escape, and water could seep in to get the towel wet.)*
- What happened at Station 7 when one of the plastic bags was filled with air? *(The side of the ruler that was attached to the blown up bag became lower than the other side, and the ruler was no longer balanced.)*
- Which bag has more mass, the one filled with air, or the empty bag? *(The one filled with air has more mass, which shows that air does have mass, as well as taking up space)*

8. Hand out a set of States of Matter cards labeled with properties of solids, liquids, and gases. Ask students to classify the cards into three groups. Use a large chart to classify the cards into three categories, and ask students to name the three categories.

Classifying Materials  
into Three Groups

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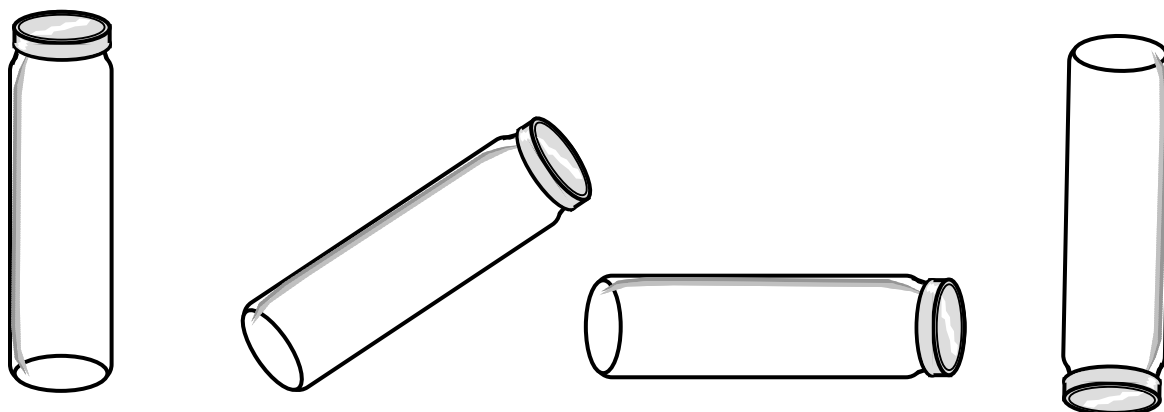
## Station 1: Soft Shapes

Materials: play dough in container, marble, tray

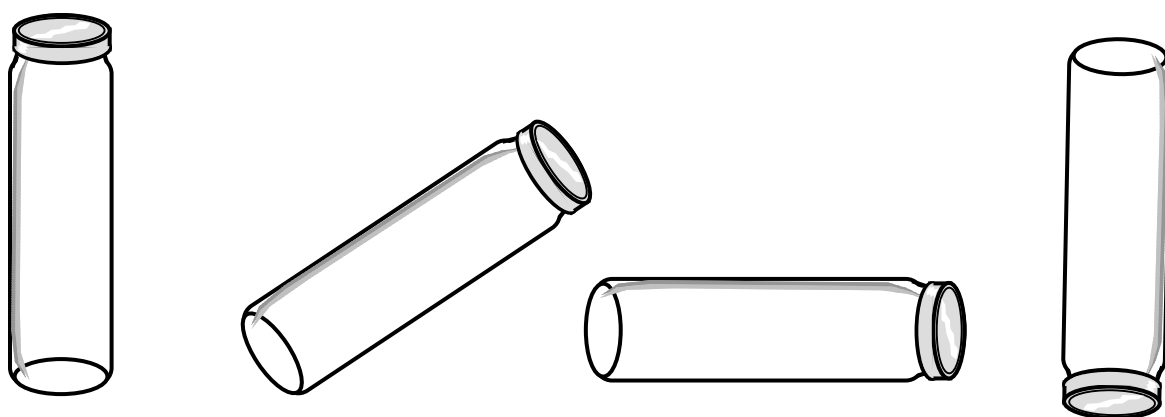
1. Open the play dough container, tip it upside down, and allow the ball of clay to fall into the tray.
2. Did the shape of the clay remain the same when it changed containers?
3. Press on the clay to make it a flat pancake. Does it keep this shape after you stop pressing on it?
4. Place the flattened clay into the container. Tip the container upside down, and allow the clay pancake to fall into the tray. Did it change shape when it changed containers?
6. Why can we press clay into a new shape? What might happen if we try to change the shape of a marble? Try to change the marble's shape, and describe what happens.
7. Which properties of a marble and a ball of clay are alike?
8. Which properties of a marble and a ball of clay are different?

**Station 2: Tip It, Turn It**

A. Observe the positions of the bottles below. Predict and draw what each bottle will look like if it is half full of water.



B. After making your predictions, fill a jar half full of water, and observe the bottle in each of the positions shown. Draw how the liquid looks in each bottle position.

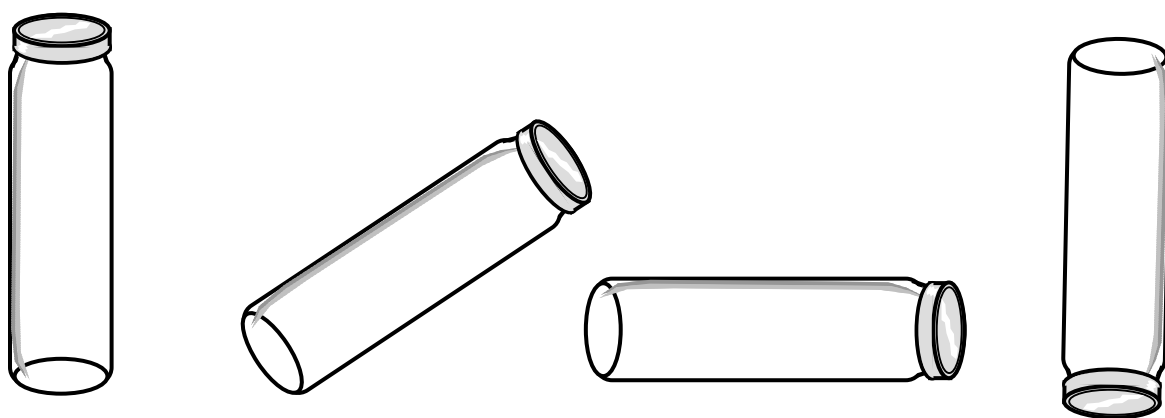


Compare the drawings in Part A and B. Were your predictions correct?

### Station 3: All Bottled Up

Materials: Bottles A, B, C, and D

Observe the materials in the bottles. Tip the bottles in the positions that are shown below.



1. How do the materials move in the bottles when they tip?
2. Roll the bottles. How do the materials move?
3. Shake the bottles. How do the materials move?
4. Do the materials in all of the bottles have some properties that are like water?
5. Do the materials in some of the bottles have different properties than water?

### **Station 4: Comparing Sand and Water**

Materials: 4 clear plastic cups, sand, water, paper towel, two trays, pennies

#### **Part A.**

1. Fill a cup half full of water, and observe the surface of the water by looking from the side. Is it an even or uneven surface?
2. Place a penny on the surface of the water. What do you observe?
3. Pour a small amount of water on a small piece of paper towel. What do you observe?
4. Pour two small rows of water in the tray. Try to combine the rows to make one row of water. What do you observe?

**Station 4: Comparing Sand and Water****Part B.**

1. Fill a cup half full of sand. Observe the surface of the sand by looking from the side. Is it an even or uneven surface?
2. Place a penny on top of the sand. What do you observe?
3. Pour a small amount of sand on a paper towel. What do you observe?
4. Pour two small rows of sand in the tray. Try to combine the rows to make one row of sand. What do you observe?
5. Based on your observations, which properties do sand and water have in common? What properties are different?

### Station 5: Does Air Take Up Space?



Materials: Envelope, sealed quart-sized plastic bag, flexible straw

1. Place the plastic bag in the envelope. Does it take up space?
2. Remove the plastic bag from the envelope. Open the seal just enough to insert the straw. Using the straw, blow up the bag with air until it is full. Quickly remove the straw, and reseal the bag. Throw the straw away.
3. Try to put the plastic bag back in the envelope. Does it fit?
4. Press gently on the side of the inflated plastic bag. Does air take up space? How do you know?
5. What might happen if the bag bursts or is opened? Open a small part of the seal, and push on the bag until it is flat. Where does the air go?



### **Station 6: Can Air Take Up Space in Water?**

**Materials:** Clear plastic cup, paper towel, tape, and clear container of colored water

1. Wad up the paper towel, and attach it to the inside bottom of the cup with a piece of tape. Turn the cup upside down to make sure the paper towel is firmly attached to the inside bottom of the cup.
2. Push the upside down cup straight down into the bucket of water until it rests on the bottom of the bucket.
3. Lift the cup out of the bucket, keeping it upside down and as straight as possible.
4. Turn the cup right side up, and feel the paper towel. Explain the results.
5. Repeat the same steps, but tip the cup sideways while it is under the water before removing it. Turn the cup right side up, and feel the paper towel. Explain the results.

### Station 7: Does Air Have Mass?

Materials: two plastic bags, ruler with string loops threaded through each hole, binder clips



1. Hold up the ruler by suspending it from the string that is threaded through its middle hole.

- Is it balanced?
- How do you know?

2. Attach the binder clips to the string loops threaded through holes at each end of the ruler. Attach a plastic bag to each binder clip.

3. Hold up the ruler by the middle string again.

- Is it still balanced?
- What does this tell you about the two plastic bags?

4. Take one of the plastic bags off, and use a straw to blow it up. Reseal the plastic bag, and attach it back on the binder clip.

5. Hold up the ruler by the middle string again.

- Is it still balanced?
- What does this tell you about the balloon filled with air?

9. Is there another way to test or measure to find out if air has mass? Explain how you would do it in the space below.

# States of Matter

## Property Cards

Flows when  
poured

Holds the shape  
it is given

Shape does not  
change when it  
is moved

Spreads out and  
fills all of the  
space in any  
container

Piles up when  
poured

Has a flat, level  
surface when  
poured

Spreads out  
when poured

Has  
mass

Has  
mass

Supports objects  
that are stacked  
or placed on it

# States of Matter

## Property Cards

Flows and  
spreads to fill  
a container

Holds the shape  
it is given until it  
is molded into a  
new shape

Has no shape of  
its own

Spreads out and  
fills all of the  
space in any  
container

Can be squeezed  
into a very small  
space

Has no shape of  
its own

May roll, slide, or  
stack

Has  
mass

Takes up space in  
an open container

Takes up space in  
an open container

## Elaborate A. Magnet Matters

Students visit the following stations, recording observations in their student journals.

### Station 1: A Flying Paperclip

1. Assemble the magnetic demonstration before the students enter the room.
2. Place a strong magnet on top of a metal can so it is not noticeable.
3. Tie a thread a thread to a paper clip, and tape the other end of the thread to the top of the table, so the paper clip is about 2 cm away from the magnet. Bring the paper clip toward the magnet until you feel the magnetic "pull," and it "floats" in the air.
4. After observing the "flying" paper clip, students should report their observations in their journals, using words and pictures.

**Materials** (details p. 54)

#### Station 1

**For each group:**

- ☐ thread
- ☐ strong magnet
- ☐ large paper clip
- ☐ metal can hold magnet

ELABORATE

Questioning Strategies

- What are the properties of the "flying" paperclip? (*Silver, hard, shiny metal, attached by a string*)
- How is this demonstration similar to the film cans we observed? (It is like the film can containing magnetic rings that had enough force or power to pull a film can containing paper clips toward it.)
- What might be attracting the paperclip?
- How could we test to find out? (Test magnets to find out what materials they attract.)

**Matter and Magnetism****Teaching Guide****Grade 3****Station 2: Stick To It!**

1. Ask students to read the station card instructions carefully before pouring the items in the baggie onto the tray.
2. Review that predict means to say in advance what you think will happen when a magnet is placed near each item. Emphasize that predictions should be made before tests are made with magnets.
3. Students should test each object, and record the results.

- What did you notice about the materials that were attracted to magnets? *(They were metal, or had metal inside a covering. Objects that were made of wood or rubber were not attracted to the magnet.)*
- Were all of the metal objects attracted to the magnets? *(Only some of the metal objects were attracted. The tiny pieces of iron filings were attracted to the magnet in a pattern.)*
- Were you surprised that some objects were not attracted to the magnet? *(Yes, because some metal objects were not attracted to the magnet, such as the penny, foil, and brass tack. Pennies are made of copper, foil is made of aluminum, and tacks are made of brass.)*
- Is the following sentence true? "Objects that stick to a magnet must be made out of metal, but not all metals stick to magnets." *(Yes, because only objects that were made out of metal stuck to the magnet. However, certain metals, like brass, aluminum, and copper did not stick to the magnet.)*
- What metal does stick to magnets? *(Iron, because the iron filings stuck to the magnet.)*

**Materials** (details p. 54)**Station 2****For each group:**

- ☐ 2 bar magnets
- ☐ ring magnets
- ☐ baggie
- ☐ pennies
- ☐ iron filings
- ☐ small petri dish
- ☐ clear tape
- ☐ paper clips
- ☐ pencil
- ☐ safety pin
- ☐ iron nail
- ☐ aluminum foil
- ☐ brass tack
- ☐ garbage twist tie
- ☐ insulated wire
- ☐ rubber band
- ☐ toothpicks

**For each student:**

- ☐ Stick to It! student data sheets

*Without touching them, a magnet pulls on all things made of iron and either pushes or pulls on other magnets.*

*Benchmarks for  
Science Literacy, p. 94*

**Station 3: Push or Pull?**

1. Take a set bar magnets out of the box. Show students the wood and metal keepers that protect the magnet when it is stored. Ask students to store the keepers in the box while using the bar magnets.
2. Ask students to record their observations in the their student journals.
  - What happened when you pushed the ends or poles of the bar magnets with the same letter (N,N) or (S,S) close together? *(If we pushed the ends of the magnets together that were marked with the same letter, it felt like the magnets were pushing away from each other.)*
  - What happened when you pushed ends or poles of the bar magnets with the same letter (N,S) or (S,N) close together? *(If we pushed the ends of the magnets together that were marked with the different letters, it felt like the magnets were pulling toward each other.)*
  - What does N stand for when you are looking at a map? *(North)* What do you think N stands for on the bar magnet? *(North)* What does S stand for when you are looking at a map? *(South)* What could S stands for on the bar magnet? *(South )*
  - Another word for pushed away is repelled. What parts of the bar magnet pushed away from each other? *(The poles marked with the same letters.)*
  - Another word for pulled toward is attracted. What parts of the bar magnet attracted each other? *(The ends marked with different letters.)*
  - Do the ring magnets behave like the bar magnets? *(Yes, because they repel or attract each, depending on the side that is facing the first magnet. They must have poles, too.)*

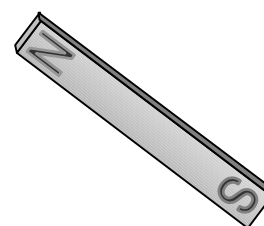
**Materials** (details p. 54)**Station 3****For each group:**

- ☐ 2 bar magnets
- ☐ 4 ring magnets
- ☐ dowel stand for ring magnets
- ☐ paper clips
- ☐ large map or globe with North and South Pole labeled

**ELABORATE**

Questioning Strategies

Bar Magnet



## Station 4: Pick Up Clips

1. Ask students to prepare a chart in their journal to record how many paper clips are attracted by each end of the magnet, and by the center. Discuss how many trials would be needed for reliability, and how that might look in chart form.
2. Demonstrate how to measure the bar magnet to find the center and how to mark it with a small piece of masking tape.
3. Discuss the best way to hold the magnet over the bowl to provide a fair test for the whole bar magnet for each trial.

## Questioning Strategies

- How did you hold the magnet over the bowl? *(Sideways, or horizontally, to provide a fair test for the whole magnet during each trial.)*
- Which part of the magnet picked up the most paper clips? *(Both ends picked up the most paper clips. The middle picked up very few.)*
- How many trials did you perform to make sure the results were reliable? *(Answers will vary.)*
- Based on the results, which part of the magnet seems the strongest? *(the poles, or ends)*

## Station 5: Which Magnet is the Strongest?

1. Review the rule of using zero as the "starting line" when measuring with the centimeter ruler.
2. Demonstrate how to place the paper clip at the starting line, and the magnet at the 10 cm mark on the cm ruler. Show how to move the magnet slightly toward the paper clip, but do not move it far enough to attract the paper clip.
3. Discuss the need to round to the nearest cm if the measurement is not exactly on the cm mark.

## Materials (details p. 54)

## Station 4

## For each group:

- ☐ bar magnets
- ☐ cm ruler
- ☐ bowl
- ☐ 2 boxes of paper clips per station
- ☐ masking tape

## Station 5

## For the class:

- ☐ cm ruler
- ☐ paper clip
- ☐ transparency of station diagram
- ☐ magnet
- ☐ overhead projector

## For each group:

- ☐ bar magnet
- ☐ ring magnet
- ☐ cylinder magnet
- ☐ cm ruler
- ☐ paper clip

## Station 6

## For each group:

- ☐ plastic bag
- ☐ penny
- ☐ toothpick
- ☐ iron nail
- ☐ paper clip
- ☐ magnetite

## For each student:

- ☐ student journal



- What happened when the magnet got close enough to attract the paper clip? (The magnet pulled it away from the zero line.)
- Which magnet attracted the paper clip from farther away? (*the cylinder magnet*)
- Which magnet did you predict would be the strongest? Was it correct?
- What are other ways to test magnet strength?

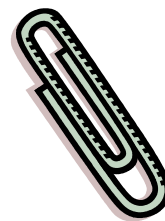
### Station 6: A Special Rock

1. Ask students to observe the magnetite and describe its properties in their journals.
2. Remind students that some properties of materials are not readily observable by using just our senses. Sometimes a test is needed to detect properties.
3. Ask them to design, perform, and record a test for the "rock."

- What properties of the rock could be observed with your senses? (*color, shape, size, texture*)
- What other properties do you want to discover about the rock?
- Describe the test you designed, and the results of the test. (*The iron nail and the paper clip were attracted to the rock, but the penny and the toothpick were not.*) (*A penny could not scratch the rock.*)
- What property of the rock did you discover? (*It is a magnetic rock, because it attracts object that are made of iron.*)
- Let's find out more about magnetite and magnets by reading a book called *What Makes a Magnet?*

### Station 1

### The Flying Paperclip



1. Observe the paperclip.
2. What could cause a paperclip to fly in the air?
3. Pass a 3x5 index card between the arm of the balance and paper clip. Is anything holding them together?
4. Blow on the paperclip. Does the paperclip move?
5. Report your observations in your journal, using words and pictures.

## **Station 2**

### **Stick To It!**

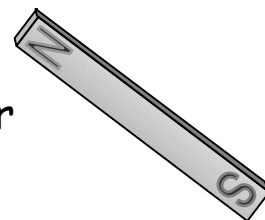
Materials: baggie, penny, iron filings sealed in a petri dish, paper clip, safety pin, iron nail, aluminum foil, brass tack, twist tie, twig, rubber band, toothpick, tray, magnet

1. Place the items in the baggie on the tray.
2. Predict which items might stick to the magnet, and record in the chart.
3. Test each item, and record if it did or did not stick to the magnet.
4. Place objects that stick to the magnet outside the tray.  
Are these objects alike in any way?
5. Leave objects that do not stick to the magnet inside the tray. Are these objects alike in any way?
6. After testing all of the items, compare your predictions to the results of your tests. Were any of the results different from your predictions?
7. Circle your predictions that were different than the test results. (Remember that a prediction states what might happen in a test, and can be revised.) Are the circled objects alike in any way?

**Matter and Magnetism****Teaching Guide****Grade 3****Stick To It!****Data Sheet**

1. Predict which objects will stick to magnets, and record by circling Yes or No under the Predict column.
2. Test each object, and record by circling Yes or No under the correct column.

Object	Predict: Will it Stick?	Sticks to the Magnet	Doesn't Stick to the Magnet
Safety pin	yes or no	yes or no	yes or no
Copper Penny	yes or no	yes or no	yes or no
Nail	yes or no	yes or no	yes or no
Twig	yes or no	yes or no	yes or no
Aluminum Foil	yes or no	yes or no	yes or no
Rubber Band	yes or no	yes or no	yes or no
Paper Clip	yes or no	yes or no	yes or no
Iron Filings	yes or no	yes or no	yes or no
Brass Tack	yes or no	yes or no	yes or no
Toothpick	yes or no	yes or no	yes or no
Twist tie	yes or no	yes or no	yes or no

**Station 3 Push or Pull?**

Materials: Bar magnets, ring magnets and holder

**A. Bar Magnets**

1. Place the ends of the bar magnet marked N closed to each other. Record the results in your journal.
2. Place the ends of the bar magnet marked S close to each other. Record the results in your journal.
3. Place an end of the bar magnet marked N near an end marked S. Record the results in your journal.

**B. Ring Magnets**

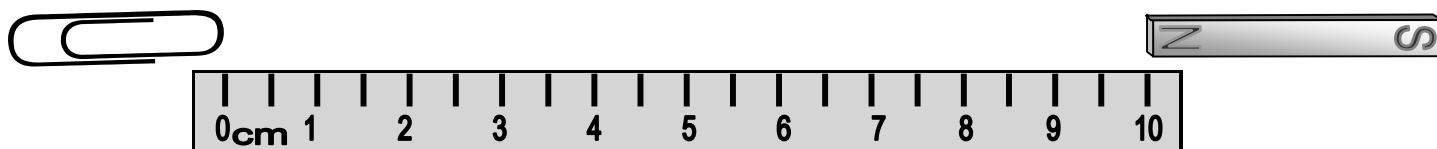
1. Observe the four circular ring magnets. Do they have any markings?
2. Pull the red ring magnet away from the others. How does it feel?
3. Predict what might happen if the red ring is turned over before it is replaced next to the other magnets. Test your prediction. Describe how the magnet behaves.
4. Slide the ring magnets on the black holder so they all stick together.
5. Slide the ring magnets on the black holder so that they do not stick together.
6. Record the results in your journal.
7. Based on your tests, compare the properties of bar and ring magnets.

### Station 4: Pick Up Clips



Materials: Bar magnets, masking tape, bowl, paperclips, cm ruler

1. Measure the bar magnet in centimeters. Find the middle of the magnet, and mark it with masking tape.
2. Put the paperclips in the bowl.
3. Prepare a chart in your journal to record how many paper clips are picked up by the ends and the middle of your bar magnet in three trials.
4. Place the bar magnet horizontally over the bowl of paperclips, then pick it up carefully.
5. Count the number of paper clips that are attached to each end and the middle of the bar magnet. Record the results in your chart.
6. Which parts of the magnet seem the strongest?
7. Which parts of the magnet seem the weakest?

**Station 5: Which Magnet is the Strongest?**

Materials: paper clip, centimeter ruler, small bar magnet, large bar magnet, cylinder magnet

Predict which magnet is the strongest, and record it in the chart. Follow these steps to test the magnets:

1. Place the end of the paper clip at the zero mark of the ruler.
2. Place the small bar magnet at the 10 cm mark on the ruler.
3. Slowly slide the magnet toward the paperclip until it attracts the paper clip. Record how many centimeters the magnet is from the paperclip when it attracts the paperclip, to the nearest centimeter.

Magnet	Distance from Paperclip
Ring Magnet	cm
Bar Magnet	cm
Cylinder Magnet	cm

Which magnet is the strongest?

What could you do to make the magnet test more reliable?

Design another test to find out which magnet is strongest. Record the test and the results in your journal.

**Station 6: The Special Rock**

Materials: Magnetite, baggie, toothpick, paper clip, penny, iron nail

1. Pick up the rock, and observe it carefully. What are its properties?
2. How could you test the rock to find out if it has other properties?
3. Using the materials in the plastic bag, design and perform a test on the rock.
4. Record your test and observations in your science journal.



**Matter and Magnetism****Teaching Guide****Grade 3****B. What Makes a Magnet?**

1. Use the tool posters to activate prior knowledge about magnets and compasses. Write information contributed by students on the poster before reading *What Makes a Magnet?*
2. Write any student questions about magnets in the question bubble.
3. After reading, add details learned to the magnet poster. Determine if all student questions were answered from reading the book. If not, suggest further research or testing is needed to find out more information.

\*Note - Honor all responses to encourage active participation. Students may rephrase their responses after reading *What Makes a Magnet?*

**Materials** (details p. 56)

- ☐ *What Makes a Magnet?* by Franklyn M. Branley
- ☐ Laminated tool posters
- ☐ Water-based overhead marker
- ☐ Vis-à-vis pen

**ELABORATE****Questioning Strategies**

- What kinds of materials are attracted to magnets? (*Metal objects that contain iron.*)
- What kinds of materials are used to make magnets? (*Materials that contain iron, so the tiny bits of iron can line up to make a magnet. Some iron-containing rocks, like magnetite, are natural magnets because the magnetic pull of the Earth's core over many thousands of years has magnetized them.*)
- How can you make a magnet out of a needle? (*Running a magnet down a needle in the same direction twenty or thirty times.*)
- Will the needle pick up iron objects? (It is only a temporary magnet. While it is a magnet, it can also be used to make a compass.)
- What is a compass? (A magnetized tool for direction that points North because of the Earth's magnetism.)

**C. Making a Compass**

1. Hold up a piece of magnetite, and review that magnetite attracts iron containing materials, as students discovered in Station 5.

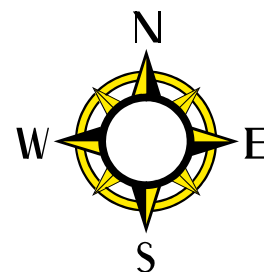
2. Ask how sailors of long ago used magnetite, as described in *What Makes a Magnet?* on pages 24-25. Tie a thread on a piece of magnetite to demonstrate how it points north when hanging from a thread. Demonstrate that a bar magnet hanging from a thread will also point North. *What Makes a Magnet?* described another way to make a compass is using a magnetized needle. Ask students to help you list the materials and steps for making a compass.

**Materials**(details p. 56)

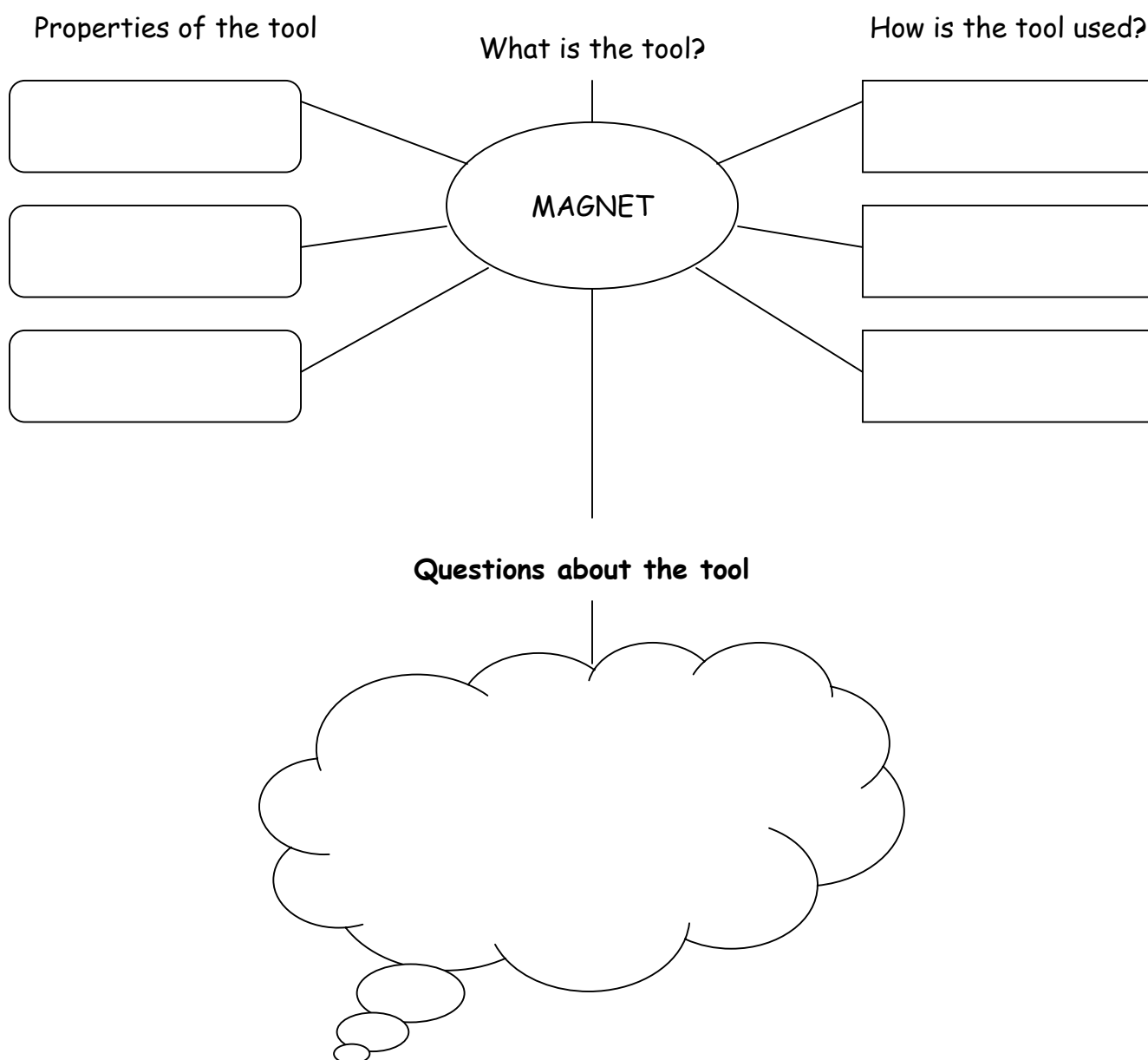
- ☐ *What Makes a Magnet?*
- ☐ Magnetite
- ☐ thread
- ☐ Bar magnet
- ☐ Needle
- ☐ paperclip
- ☐ Two corks
- ☐ Sharpie pen
- ☐ Bowl of water
- ☐ compass

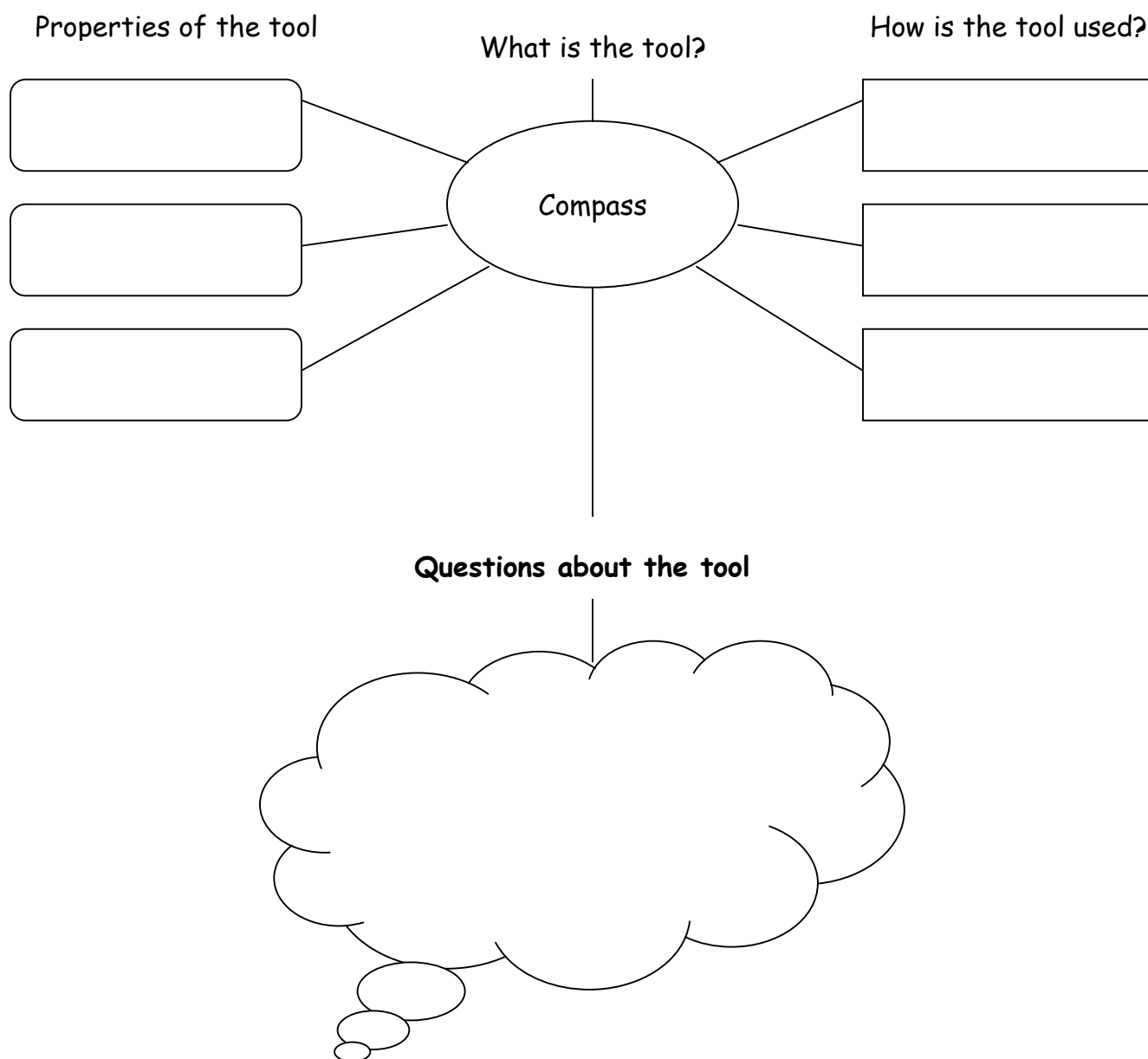
**ELABORATE****Making a Compass**

1. Hold the needle by the eye end, and move the point over the north pole of the bar magnet twenty or thirty times in one direction only. (Do not rub the needle back and forth, because the iron bits in the needle will not be able to line up and make the needle magnetized.) Repeat the procedure for the eye of the needle on the south pole of the magnet, moving in one direction only.
2. Put a cork on both ends of the needle.
3. Float the needle in the center of a bowl of water, so it can turn freely.
4. One end will point toward the north. Check it by rotating the needle the opposite way. When you let go, that end will swing around to point north, making a compass.
5. Check the accuracy of the homemade compass by using a real compass to locate north.



## TOOL CONCEPT MAP



**TOOL CONCEPT MAP**

**D. Magnet Relay Race**

1. Explain that a relay race is a team or group effort to complete a task, with all group members having an opportunity to participate. The object of the magnet relay race is to pick up as many large paper clips as possible with a magnet, and then bring the magnet and the paper clips back to the next team member.
2. Allow each group to look at, (not test), the assorted magnets in the container, and choose one to use in the relay race. Groups must come to a consensus on which magnet they choose in exactly one minute.
3. Line student groups up at one end of the gym or room behind each masking tape "Start" line. One student desk with an egg carton of paper clips should be set up across from each starting line.
4. Students must follow these rules:
  - a. Students may **walk** quickly to the desk with the magnet to pick up paper clips. Runners must go back to the "Start" line.
  - b. The magnet may only be held directly over the egg carton containing paper clips. If the magnet is placed in the egg carton, the person will have to go back to the "Start" line to begin again.
  - c. After picking up a paper clip with the magnet, each student will carefully walk back to the group line to hand it to the next person.
  - d. The team that picks up the most paper clips in three minutes wins.
5. After the race, compare strength of the magnets. Is the biggest magnet always the strongest?

**Materials** (details p.56)

- ☐ Container for magnets
- ☐ magnets of different sizes and strengths
- ☐ large paper clips
- ☐ egg cartons
- ☐ masking tape
- ☐ one student table for each group
- ☐ whistle or chime

**ELABORATE**

## E. Featured Attractions



1. Demonstrate how to put a paperclip on the back of a figure on a piece of cardboard to make a puppet.

2. Hold a magnet on the back of a piece of poster board, and place the figure on the front of the poster board near the magnet. Demonstrate how to move the magnet to make the puppet move around the board.

3. Ask each group to prepare a color posterboard to dramatize a story. Each person in the group should have a magnet puppet, and be responsible for moving and speaking for the puppet.

4. If students dramatized pages 24-25 of *What Makes a Magnet?*, they could deepen their understanding of magnetite as "lodestones" or compasses, as well as gaining an appreciation for the history of science and the contributions of scientists.

## Questioning Strategies

- What might have happened to early sailors if they had no compass? (They might have been lost at sea.)
- How do people use a compass now? (Airplane pilots, ship captains, and hikers all need a compass to keep from getting lost.)
- Why does a compass point North on Earth? (The Earth acts like a huge magnet because it has iron in its core or center.)
- Would a compass work on the moon? (No, because the moon does not have as much iron in its core, so it would not have a north pole to attract the north-seeking pole of the compass.)

## Materials (details p.56)

## For each group:

- ☐ *What Makes a Magnet?*
- ☐ poster board
- ☐ magnets
- ☐ pencils
- ☐ markers or paints
- ☐ tag board

## ELABORATE

*Students need to acquire images and understandings that come from drawing, painting, sculpting, playing music, acting in plays, listening to and telling stories, reading, participating in games and sports, doing work, and living life.*

*Benchmarks for Science Literacy, p. 267*

**EVALUATE**

1. Students individually complete selected response items on matter and magnetism.
2. Students complete the performance assessment as groups or individually.
3. Prepare a set of three plastic jars for each group. Fill one half full of sand, and put a paper clip on the surface of the sand. Fill one half full of water, and drop a paperclip in the center of the jar. Place the third paperclip in an empty jar.
4. Student groups design an investigation to move a paperclip out of a jar of sand, a jar of water, and a jar of air, without touching the paperclip or putting the magnet in the jar.
  - A. Demonstrate understanding of the properties of matter in solid, liquid, and gas states
  - B. Demonstrate an understanding of magnetic properties, including polarity
  - C. Demonstrate the safe use of magnets and other lab materials
5. Assess completed Matter and Magnetism student journal, and assign a rubric score.

**Materials** (details p. 57)**For each group:**

- ☐ 3 plastic jars
- ☐ bar magnet
- ☐ sand
- ☐ 3 paper clips
- ☐ water

**For each student:**

- ☐ Matter and Magnetism Assessment sheets
- ☐ Matter and Magnetism Rubric

**EVALUATE**

## Matter and Magnetism Assessment

1. A student discovered that when he placed two bar magnets ends close to each other, they pulled toward each other with a strong force. Which diagram below shows how the student placed the magnets? Bubble the letter of the correct choice.

- ☐ A      
- ☐ B      
- ☐ C      

2. A student placed a strong magnet near a penny, an iron nail, a brass tack, a steel wire, and an aluminum can.

Did the magnet attract any of these objects? \_\_\_\_\_

If so, which objects were attracted to the magnet?

\_\_\_\_\_

3. A student wanted to pick up as many paper clips as possible during his turn of the magnet relay race. His bar magnet was wider than the bowl of paper clips, so he placed the center of his bar magnet over the bowl. Did this student pick up more paperclips than a student who placed the end of her magnet over the bowl of paper clips? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



4. A student tests a material to find out about its properties. The result of one of the tests is pictured below. What properties did the student discover about the material? What other tests could be done to find out more properties of the material?

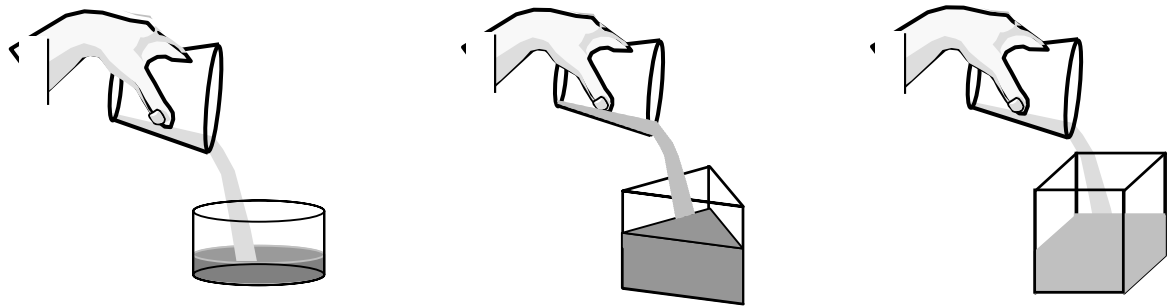
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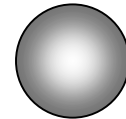
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5. Explain which properties of a material you could discover by using the tests shown below.



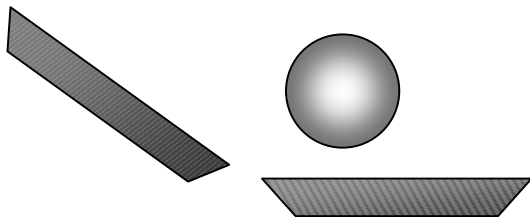
Test One: Roll the material into a round ball.

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Test Two: Place the ball on a balance.

---

Test Three: Pour the ball from one pan to another pan.




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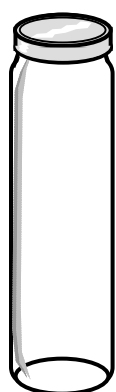
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Matter and Magnetism  
Performance Assessment

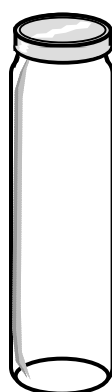
Materials: 3 plastic jars, bar magnet, sand, 3 paper clips, water

Find a way to remove the paper clip from the jar of sand, water, and air without touching the paperclip or putting the magnet in the jars.

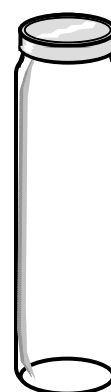
Draw your plan on each jar picture, showing how you will use the magnet.



Sand



Water



Air

Write the results of your tests below.

---

---

---

I conclude that magnets can attract paper clips

through \_\_\_\_\_ because

---

## Matter and Magnetism

### Scoring Rubric

Task	Criteria	
1. Properties of Magnets	Demonstrates understanding that: magnets attract metal objects that contain iron, magnets have two poles, magnetic force is stronger at the poles than in the center, like poles repel while opposite poles attract.	4
	Demonstrates understanding of most magnetic properties, with one omission.	3
	Demonstrates understanding of some magnetic properties, with two omissions.	2
	Demonstrates understanding of few magnetic properties, with three omissions.	1
	Demonstrates understanding of very few magnetic properties, with four omissions.	0
2. Properties of Matter	Demonstrates understanding that: Matter has mass and takes up space. Matter exists in 3 states: (1) Solids maintain their shape when moved into different containers, and take up a definite space; (2) Liquids flow when poured, and take the shape of their containers; (3) Gases have no shape and spread out to completely fill any container.	4
	Demonstrates understanding of most properties of matter, with one omission.	3
	Demonstrates understanding of some properties of matter, with two omissions.	2
	Demonstrates understanding of few properties of matter, with three omissions.	1
	Demonstrates understanding of very few properties of matter, with four omissions.	0
3. Matter and Magnetism Performance Assessment	Solves the problem, and clearly communicates the solution in words and pictures. Demonstrates and communicates deep understanding of the properties of matter in solid, liquid, and gas forms, and properties of polarity by using ends of magnet to attract the paper clip.	4
	Solves the problem, and communicates the solution in words and pictures. Demonstrates and communicates a basic understanding of the properties of matter in solid, liquid, and gas forms, and properties of polarity by using ends of magnet to attract the paper clip.	3
	Solves the problem, and communicates the solution in words and pictures. Demonstrates and communicates misconceptions about the properties of matter in solid, liquid, and gas forms, and properties of polarity by using the middle of the magnet to attract the paper clip.	2
	Makes an attempt to solve problem, but the solution is incomplete. Needs more experiences to understand properties of matter and magnetism.	1
	Does not attempt to solve problem.	0

**Matter and Magnetism****Teaching Guide****Grade 3****Lab Skills, Safety and Journaling**

Task	Criteria	
3. Lab Skills, Safety, and Participation	Selects and uses appropriate equipment with care and proficiency. Handles magnets and compass with great care. Listens attentively, and stays actively involved in each activity.	4
	Uncertain about equipment selection, but uses equipment carefully. Handles magnets and compass with care. Listens to instructions and stays involved, but may wait for others to lead.	3
	Is not familiar with use of equipment, so often makes inappropriate choices, but does not abuse equipment. Handles magnets with care, with reminders. Distracted during instructions, so must rely on others for directions.	2
	Uses equipment improperly, and is haphazard and disorganized. Needs to review rules for safe handling of magnets. Is distracted during instructions, and needs constant reminders to stay on task.	1
	Does not use equipment or abuses equipment. Handles magnets carelessly. Is disruptive during instructions and activity.	0
4. Matter and Magnetism Science Journal	Contains very detailed entries and labeled drawings that clearly communicate each learning experience, no omissions. Makes relevant inferences and connections with matter and magnetism concepts. Very neat and well organized.	4
	Contains detailed entries and labeled drawings that communicate each learning experience, with one omission. Asks relevant questions, and makes inferences and connections with matter and magnetism concepts. Neat and organized.	3
	Contains fairly detailed entries and drawings, with two omissions. Asks questions, and makes some inferences and connections with matter. Neat, but may need to spend more time organizing entries.	2
	Contains some entries and drawings, with three omissions. Asks few questions, and makes few inferences and connections with matter concepts. May need to spend more time on neatness and organizing entries.	1
	Contains minimal entries and drawings, with four or more omissions. Makes no inferences or connections with optical systems concepts. Needs to spend more time on neatness and organizing entries.	0

## Materials Detail Sheet

### **ENGAGE**

#### **The Property Game**

##### **For each group:**

A paper bag containing a secret object, which is labeled with a letter A-P

- ☐ A square wooden block
- ☐ B water balloon
- ☐ C air-filled balloon
- ☐ D toy truck
- ☐ E steel ball
- ☐ F wooden ball
- ☐ G cotton ball
- ☐ H large marble
- ☐ I yo-yo
- ☐ J light up shoe
- ☐ K sharpener
- ☐ L cylinder block
- ☐ M sand- filled balloon
- ☐ N bean bag animal
- ☐ O flashlight
- ☐ P refrigerator magnet

#### **Closed Mystery Cans**

##### **For each group:**

Set of numbered film cans, containing:

- ☐ 1- marble
- ☐ 2- steel ball
- ☐ 3- paper clips
- ☐ 4- ring magnets
- ☐ 5- sand
- ☐ 6- water
- ☐ 7- air (empty, but spray inside of can with perfume)
- ☐ 8- cotton ball
- ☐ plastic tray
- ☐ double pan balance

**Matter and Magnetism****Teaching Guide****Grade 3**

- ❑ centimeter ruler

**For each student:**

- ❑ Closed Mystery Can student data sheets or student journals
- ❑ student journals
- ❑ laminated Three Groups of Materials student sorting page

**EXPLORE****Open Mystery Cans****For each group:**

- ❑ Set of numbered film cans from the Explore section
- ❑ plastic tray
- ❑ double pan balance
- ❑ centimeter ruler

**For each student:**

- ❑ Open Mystery Can student data sheets or student journals
- ❑ student journals
- ❑ laminated Three Groups of Materials student sorting page

**EXPLAIN****For each group:**

- ❑ Set of numbered film cans from the Explore section
- ❑ plastic tray

**For each student:**

- ❑ Open Mystery Can student data sheets or student journals
- ❑ student journals

**For each group:****1. Station 1: Soft Shapes**

- ❑ Play dough
- ❑ Play dough container
- ❑ tray
- ❑ student journal
- ❑ Station 1 card

**Station 2. Tip It, Turn It**

- ❑ bottles with lids
- ❑ water
- ❑ Station 2 card

**Station 3 All Bottled Up**

- ❑ 4 bottles with lids marked and filled with:
  - A colored water
  - B corn syrup
  - C mineral oil
  - D dishwashing soap
- ❑ Station 2 card

**Station 4 Comparing Sand and Water**

- ❑ 4 clear plastic cups
- ❑ sand
- ❑ water
- ❑ tray
- ❑ Station 4 card

**Station 5 and 6: Does Air Take Up Space?**

- ❑ perfume
- ❑ envelope
- ❑ quart-size baggie
- ❑ clear plastic cup,
- ❑ paper towel
- ❑ tape
- ❑ bucket of water

**Station 7: Does Air Have Mass?**

- ❑ tape
- ❑ binder clips
- ❑ plastic bags
- ❑ ruler
- ❑ flexible straw
- ❑ 3 pieces of string
- ❑ Set of States of Matter Property Cards

**ELABORATE****A. Magnet Matters****Station 1****For each group:**

- ☐ thread
- ☐ strong magnet
- ☐ large paper clip
- ☐ metal can to hold magnet
- ☐

**Station 2****For each group:**

- ☐ 2 bar magnets
- ☐ ring magnets
- ☐ baggie
- ☐ pennies
- ☐ iron filings (Available in all science catalogs, and should be sealed in petri dishes.)
- ☐ small petri dish (Available in all science catalogs, and used to hold iron filings.)
- ☐ clear tape ( Seal edge of petri dish to prevent iron filings from spilling out .)
- ☐ paper clips
- ☐ pencil
- ☐ safety pin
- ☐ iron nail
- ☐ aluminum foil
- ☐ brass tack (Make sure the tack is **really** brass, and not attracted to the magnet.)
- ☐ garbage twist tie
- ☐ insulated wire
- ☐ rubber band
- ☐ toothpicks

**For each student:**

Stick to It! student data sheets

**Station 3****For each group:**

- ☐ 2 bar magnets
- ☐ 4 ring magnets
- ☐ dowel stand for ring magnets



**Matter and Magnetism****Teaching Guide****Grade 3**

- ☐ paper clips
- ☐ large map or globe with North and South Pole labeled

**Station 4****For each group:**

- ☐ bar magnets
- ☐ cm ruler
- ☐ bowl
- ☐ 2 boxes of paper clips per station
- ☐ masking tape

**Station 5****For the class:**

- ☐ cm ruler
- ☐ paper clip
- ☐ transparency of station card
- ☐ magnet
- ☐ overhead projector

**For each group:**

- ☐ bar magnet
- ☐ ring magnet
- ☐ cylinder magnet
- ☐ cm ruler
- ☐ paper clip

**Station 6****For each group:**

- ☐ plastic bag
- ☐ penny
- ☐ toothpick
- ☐ iron nail
- ☐ paper clip
- ☐ magnetite

**For each student:**

- ☐ student journal

**B. What Makes a Magnet?****For the class:**

- ❑ *What Makes a Magnet?* By Franklyn M. Branley (\$4.95 at most bookstores)
- ❑ Laminated tool posters (Enlarge student versions)
- ❑ Water-based overhead marker
- ❑ Vis-à-vis pen

**C. Making a Compass****For each group:**

- ❑ *What Makes a Magnet?* by Franklyn M. Branley (\$4.95 at most bookstores)
- ❑ Magnetite (available in Carolina and Boreal catalogs under rocks and minerals)
- ❑ thread
- ❑ Bar magnet (available in most science catalogs, including ETA and Delta)
- ❑ Needle
- ❑ paperclip
- ❑ Two corks
- ❑ Sharpie pen
- ❑ Bowl of water
- ❑ Compass (available in most science catalogs, including ETA and Delta)

**D. Magnet Relay Race****For the class:**

- ❑ Container for magnets
- ❑ magnets of different sizes and strengths
- ❑ large paper clips
- ❑ egg cartons
- ❑ masking tape
- ❑ one student table for each group
- ❑ whistle or chime

**E. Featured Attractions****For each group:**

- ❑ *What Makes a Magnet?*
- ❑ poster board
- ❑ magnets
- ❑ pencils
- ❑ markers or paints

- ❑ tag board

## **EVALUATE**

**For each group:**

- ❑ 3 plastic jars
- ❑ bar magnet
- ❑ sand
- ❑ 3 paper clips
- ❑ water

**For each student:**

- ❑ Matter and Magnetism Assessment sheets
- ❑ Matter and Magnetism Rubric

## Background Information for Teachers

All of the materials around us that have mass and take up space are made of matter. The words *matter* and *material* both come from the Latin word meaning "stuff." Matter can be described by its **properties**, such as hardness, color, smell, shape, density, magnetism, melting point, boiling point, or freezing point. Most matter on Earth can exist in a solid, liquid or gas state, depending on its temperature and the energy level of its particles. Matter can change from one state to another by adding or taking away heat energy.

Solids, like bricks, tend to keep their shape because the particles they are made of are tightly packed together in a pattern, and can't move around much. This allows solids to hold their own shape, even if they are moved, rolled, slid or placed in new containers. A solid can be reshaped by being ground up so that it fills a container, but looking at the powdered solid under the microscope would still show little pieces of solid that still maintain their own shape. For example, if a powdered solid is poured on a flat surface, it heaps or piles up. The particles in solid matter have low energy, and cannot move around or past each other. This gives solids a definite shape and a definite volume.

Solids can be further classified by their hardness, which determines how much effort it might take to shape it into a new form. Some hard solids are difficult to reshape, because they are brittle and break instead of reforming into the new shape. Many metals are hard solids that can be hammered into new shapes, so they have the property of being malleable. Some solids, like clay, butter, and chocolate, are softer, which makes it easier to form them into a new shape. The property of being hard or soft would also affect another property of a solid, the melting point. The melting point of a solid is when enough heat is added to melt it into a liquid form.

Unlike solids, liquids can't hold their shape. They simply flow into the shape of their container. In liquid matter, the particles have enough energy to flow past each other, which allows them to flow and take the shape of their container until it is filled to its capacity or volume. So, even though liquids do not have a definite shape, they do have a definite volume. Liquids also form a smooth surface when poured, unlike the piles that occur when granular solids, such as sand or salt, are poured. If a liquid is poured on a flat surface, it simply spreads out over the surface.

If enough heat is added to a liquid, the particles start to move faster, and either evaporates as a gas from the surface, or form gas bubbles within the liquid. This is known as the boiling point of the liquid, which is another property of a liquid.

When matter has enough energy for its particles to bounce off each other and the sides of any sized container, it is considered a gas. A gas can fill a container of any size or shape because gas particles keep moving even after they are evenly spread throughout a container, room, or the atmosphere. Gases have no definite shape or volume, because they can expand to fill a container, or be compressed by pressure.

### **Magnetism**

The invisible force of magnetism fascinates students of all ages. As students observe magnets interacting with substances that are made of iron or with other magnets, they begin to understand that there are invisible forces that can pull objects closer together or push them apart. *Benchmarks* recommends that development of concepts about magnetic forces should begin early, stating that "even in the primary years, children should use magnets to get things to move without touching them, and thereby learn that forces can act at a distance with no perceivable substance in between." (Benchmarks, p. 94) From the 3<sup>rd</sup> to the 5<sup>th</sup> grade, students should "carry out investigations to become familiar with the pushes and pulls of magnets and static electricity." (Benchmarks, p. 94)

Students should have many opportunities to discover that magnetic properties reveal themselves when a magnet is interacting with other materials. We can't actually see magnetism, but we can see what happens when a magnet is placed near different materials. The invisible lines of force in the magnetic field surrounding a magnet can attract some metals, such as iron, nickel, cobalt, and steel. Magnets do not attract other metals, such as copper, brass and aluminum. Materials that are not metal are also not attracted to magnets.

Magnets can also interact with each other because of the invisible lines of force that surround them. Magnets will attract, or pull toward each other, if unlike poles are near each other. Magnets will push away, or repel each other, if two poles of the same kind are near each other. If two North poles are placed near each other, the magnets will repel each other. If a North and a South pole are placed near each

**Matter and Magnetism****Teaching Guide****Grade 3**

other, the magnets will be attracted to each other. The rule for any magnet is that like poles repel, while unlike poles attract.

Important facts about magnets:

1. Objects made of iron, nickel, cobalt, and steel are attracted to a magnet. Most metals except for these are not magnetic.
2. Nonmetals are not magnetic.
3. All magnets have two opposite poles, called North and South.
4. Opposite poles (North/South) of a magnet attract each other, while like poles (South/South) repel each other.
5. The Earth acts like a huge magnet because of its core.

Use and Care of Magnets:

1. Wear safety glasses when using magnets and iron filings to protect eyes.
2. Move magnets slowly toward each other to prevent fingers from being pinched between strong magnets when they are attracted together.
3. Dropping or snapping magnets together can cause magnets to chip or lose strength.
4. Never heat a magnet, because it will cause them to lose strength.

\*Prevent magnetic damage to household items by keeping magnets away from video or audio tapes, credit cards, floppy disks, TV and computer monitors.

## Targeted Texas Essential Knowledge & Skills



### Science TEKS

- 3.1 The student conducts field and laboratory investigations following home and school safety procedures and environmentally appropriate and ethical practices. The student is expected to:
- (A) demonstrate safe practices during field and laboratory investigations.
- 3.2 The student uses scientific inquiry methods during field and laboratory investigations. The student is expected to:
- (A) plan and implement descriptive investigations including asking well-defined questions, formulating testable hypotheses, and selecting and using equipment and technology;
  - (B) collect information by observing and measuring;
  - (C) analyze and interpret information to construct reasonable explanations from direct and indirect evidence;
  - (D) communicate valid conclusions; and
  - (E) construct simple graphs, tables, maps and charts to organize, examine, and evaluate information.
- 3.4 The student knows how to use a variety of tools and methods to conduct science inquiry. The student is expected to:
- (A) collect and analyze information using tools including calculators, microscopes, cameras, safety goggles, sound recorders, clocks, computers, thermometers, hand lenses, meter sticks, rulers, balances, magnets, and compasses; and
  - (B) demonstrate that repeated investigations may increase the reliability of the results.
- 3.7 The student knows that matter has physical properties. The student is expected to:
- (A) gather information including temperature, magnetism, hardness, and mass using appropriate tools to identify physical properties of matter; and
  - (B) identify matter as solids, liquids, and gases.



## Language Arts TEKS

3.1 Listening/speaking/purposes. The student listens attentively and engages in a variety of oral language experiences. The student is expected to:

- (A) determine the purposes for listening such as to get information, to solve problems, and to enjoy and appreciate;
- (C) participate in rhymes, songs, conversations, and discussions; and
- (D) listen critically to interpret and evaluate.

3.3 Listening/speaking/audiences/oral grammar. The student speaks appropriately to different audiences for different purposes and occasions. The student is expected to:

- (A) choose and adapt spoken language appropriate to the audience, purpose, and occasion, including use of appropriate volume and rate;
- (C) ask and answer relevant questions and make contributions in small or large group discussions;
- (E) give precise directions and instructions such as in games and tasks; and
- (F) clarify and support spoken ideas with evidence, elaborations, and examples.

3.4 Listening/speaking/communication. The student communicates clearly by putting thoughts and feelings into spoken words. The student is expected to:

- (A) use vocabulary to describe clearly ideas, feelings, and experiences; and
- (B) clarify and support spoken messages using appropriate props, including objects, pictures, and charts.

3.7 Reading/variety of texts. The student reads widely for different purposes in varied sources. The student is expected to:

- (B) read from a variety of genres for pleasure and to acquire information from both print and electronic sources
- (C) read to accomplish various purposes, both assigned and self-selected

3.8 Reading/vocabulary development. The student develops an extensive vocabulary. The student is expected to:

- (A) develop vocabulary by listening to and discussing both familiar and conceptually challenging selections read aloud; and
- (B) develop vocabulary through reading.

3.9 Reading/Comprehension. The student uses a variety of strategies to comprehend selections to be read aloud and selections read independently. The student is expected to:



**Matter and Magnetism****Teaching Guide****Grade 3**

- (A) use prior knowledge to anticipate meaning and make sense of texts;
- (B) establish purposes for reading and listening such as to be informed, to follow directions, and to be entertained;
- (D) monitor his/her own comprehension and act purposefully when comprehension breaks down using strategies such as rereading, searching for clues, and asking for help;
- (F) make and explain inferences from texts such as determining important ideas and causes and effects, making predictions, and drawing conclusions;
- (I) represent text information in different ways, including story maps, graphs, and charts; and
- (J) distinguish fact from opinion in various texts, including news stories and advertisements.

3.10 Reading/literary/response. The student responds to various texts. The student is expected to:

- (A) respond to stories and poems in ways that reflect understanding and interpretation in discussion (speculating, questioning) in writing, and through movement, music, art, and drama;
- (B) demonstrate understanding of informational text in various ways such as through writing, illustrating, developing demonstrations, and using available technology; and
- (C) support interpretations or conclusions with examples drawn from text.

3.11 Reading/text structures/literary concepts. The student recognizes characteristics of various types of texts. The student is expected to:

- (B) distinguish fiction from nonfiction, including fact and fantasy; and
- (C) recognizes the distinguishing features of familiar genres, including stories, poems, and information texts.

3.12 Reading/inquiry/research. The student generates questions and conducts research about topics using information from a variety of sources including selections read aloud. The student is expected to:

- (B) use multiple sources, including print such as an encyclopedia, technology, and experts, to locate information that addresses questions;
- (C) interpret and use graphic sources of information, including maps, charts, graphs, and diagrams;
- (D) organize information in systematic ways, including notes, charts, and labels;
- (E) demonstrate learning through productions and displays such as oral and written reports, murals, and dramatizations
- (F) use compiled information and knowledge to raise additional, unanswered questions; and
- (G) draw conclusions about information gathered.

3.20 Writing/inquiry/research. The student uses writing as a tool for learning and research. The student is expected to:

- (B) record his/her knowledge of a topic in a variety of ways such as by drawing pictures, making lists, and showing connections among ideas; and
- (A) record his/her knowledge from relevant sources such as classroom guests, books, and media sources.



## **Mathematics TEKS**

3.11 Measurement. The student selects and uses appropriate units and procedures to measure length and area. The student is expected to:

- (A) estimate and measure lengths using standard units such as inch, foot, yard, centimeter, decimeter, and meter.

3.13 Measurement. The student applies measurement concepts. The student is expected to measure to solve problems involving length, area, temperature, and time.

3.15 Underlying processes and mathematical tools. The student applies Grade 3 mathematics to solve problems connected to everyday experiences and activities in and outside of school. The student is expected to:

- (C) select or develop an appropriate problem solving strategy, including drawing a picture, looking for a pattern, systematic guessing and checking, acting it out, making a table, working a simpler problem, or working backwards to solve a problem.

3.16 Underlying processes and mathematical tools. The student communicates about Grade 3 mathematics using informal language. The student is expected to:

- (A) explain and record observations using objects, words, pictures, numbers, and technology .

3.17 Underlying processes and mathematical tools. The student uses logical reasoning to make sense of his or her world.

- (A) make generalizations from patterns or sets of examples and nonexamples.

**Social Studies TEKS**

**3.5 Geography.** The student understands the concepts of location, distance, and direction on maps and globes. The student is expected to:

- (C) identify and use the compass rose, grid, and symbols to locate places on maps and globes.

**Art TEKS**

**3.2 Creative expression/performance.** The student expresses ideas through original artworks, using a variety of media with appropriate skill. The student is expected to:

- (A) develop artwork based on personal observations and experiences; and
- (C) produce drawings, paintings, prints, constructions, ceramics, and fiber art, using a variety of art materials appropriately.

**Physical Education TEKS**

**2.1 Movement.** The student demonstrates competency in fundamental movement patterns and proficiency in a few specialized movement forms. The student is expected to:

- (A) travel forward, sideways, and backwards and change direction quickly and safely in dynamic situations; and
- (E) demonstrate proper body alignment in lifting, carrying, pushing, and pulling.

## Language Arts Connections

*Electricity and Magnetism Fundamentals.* Wood, Robert. Chelsea House Publishers, Philadelphia, 1997.

(ISBN 0-7910-4841-1) Magnetizing hands-on activities for young scientists.

*Experiments with Solids, Liquids, & Gases.* Tocci, Salvatore. Scholastic Library Publishing, (ISBN 0516273523) Discusses and provides experiences with matter in three states.

*Forces Around Us.* Hewitt, Sally. Scholastic Library Publishing, 1998.

(ISBN 0516263900) Discusses magnetism as a force.

*Magnetism.* Riley, Peter D. Scholastic Library Publishing, 1999

(ISBN 053115372X) Introduces magnetism, including types of magnets, magnetic force, poles of the Earth, and electromagnets.

*Planet Earth / Inside Out.* Gail Gibbons. Morrow Junior Books, New York, 1995.

(ISBN 0-688-09680-8) Provides clear explanations about the internal and external characteristics of the Earth, with beautiful illustrations.

*Playing with Magnets.* Gibson, Gary. Copper Beech Books, Brookfield, Connecticut, 1995.

(ISBN 1-56294-633-1) Contains a variety of hands-on activities to help students understand basic magnetic principles.

*Solids, Liquids, and Gases.* The Ontario Science Center, Kids Can Press, Unlimited, 2000.

(ISBN 1550744011) Introduces matter, and provides activities to experience each state.

*What is the World Made Of?* Zoehfeld, Kathleen. 1998

(ISBN 0064451631) Discusses properties and provides examples of solids, liquids, and gases.

*What Makes a Magnet?* Franklyn M. Branley. Harper Collins Publishers, New York, 1996.

(ISBN 0-06-445148-8) Illustrated and written in a humorous style that explains the properties of magnets, and describes how to make a magnet and a compass.

## Student Internet Links

Enchanted Learning - Earth Science

<http://www.enchantedlearning.com/subjects/astronomy/planets/earth/Inside.shtml>

Exploratorium

<http://www.exploratorium.edu/origins/cern/ideas/forces.html>

## References

Ardley, Neil. *101 Great Science Experiments*. DK Publishing, New York, 1998.

Barber, Jacqueline. *Solids, Liquids, and Gases for Grades 3-6*. Lawrence Hall of Science, University of California, Berkley, 2000. (ISBN 0924886277)

*Benchmarks for Science Literacy*. Oxford University Press, New York, 1993.

Catherall, Ed. *Magnets*. Silver Burdett Company, Morristown, N.J., 1982

Doherty, Paul, and Rathjen, Don. *The Cool Hot Rod and other Electrifying Experiments on Energy and Matter*. John Wiley and Sons, Inc., New York, 1996.

Glover, David. *Batteries, Bulbs, and Wires*. Kingfisher Books, New York, 1993.  
(ISBN 185697-933-4) Provides projects and activities to illustrate the use of electricity and magnets in everyday life.

National Science Education Standards. National Academy Press, Washington, DC, 1996.

Simon, Charnan. *Solids, Liquids, and Gases*. Compass Point Books, 2000. (ISBN 0756500370)  
An introduction to the properties of matter using simple examples that children can understand.

Tomecek, Steve. *Simple Attractions*. W. H. Freeman and Company, New York, 1995.

## Websites

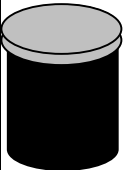
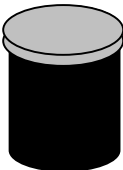
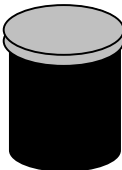
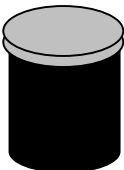
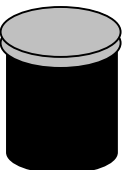
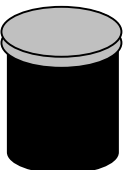


Cool Experiments with Magnets

<http://my.execpc.com/~rroadley/magindex.htm>

Name: \_\_\_\_\_

### Closed Mystery Cans

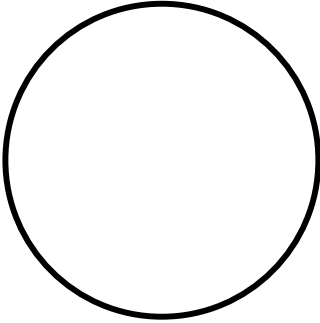
Observe the **closed** cans and record as many properties of the materials from each can in the correct column. Predict what each can might contain, and write it in the box below each numbered can.

	1	2	3	4	5	6	7	8
Property								
Mass In Grams								
Slides								
Rattles								
Sloshes								
Rolls								
Silent								
I predict the object in the can is								

## Three Groups of Materials in Closed Cans

Classify the film cans into three groups. Write the numbers of the film cans that are grouped together in each circle. List the **properties** you used to classify the members of each group on the lines next to the circle.

Group 1



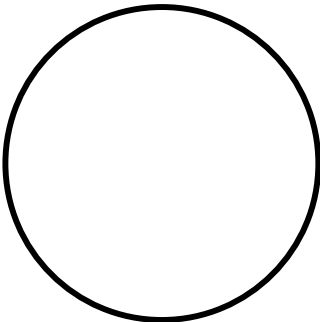
Properties

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Group 2



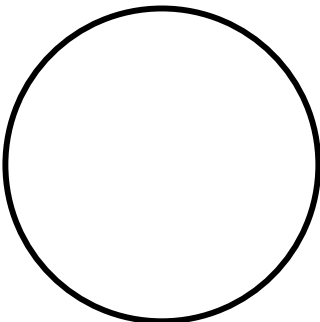
Properties

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Group 3



Properties

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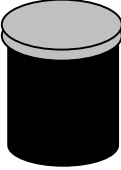
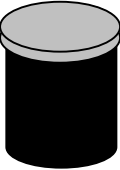
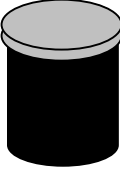
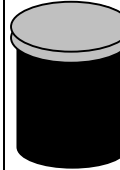
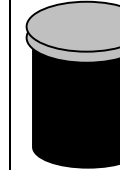
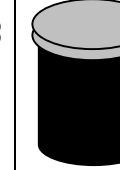
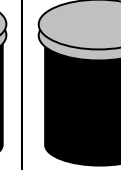
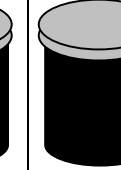
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Name: \_\_\_\_\_

## Open Mystery Cans

Pour the material in each can onto the tray. Record the properties of the materials from each can in the correct column. Write the name of the object in the box under each can. Were your predictions correct?

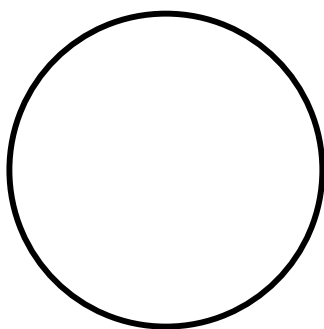
Property	1 	2 	3 	4 	5 	6 	7 	8 
Piles up								
Shape								
Color								
Texture								
Mass								
Hardness								
Rolls								
Slides								
Piles up								
Flows								
Spreads out								
Object								



## Three Groups of Materials in Open Cans

Write the numbers of the film cans that are grouped together in each circle.  
List the **properties** you used to classify the members of each group on the lines  
next to the circle. Did your classification change?

Group 1



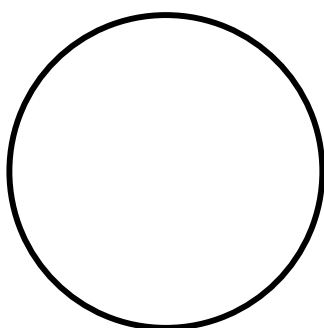
Properties

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Group 2



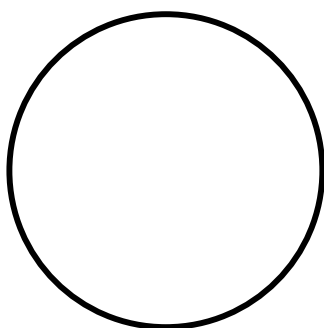
Properties

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Group 3



Properties

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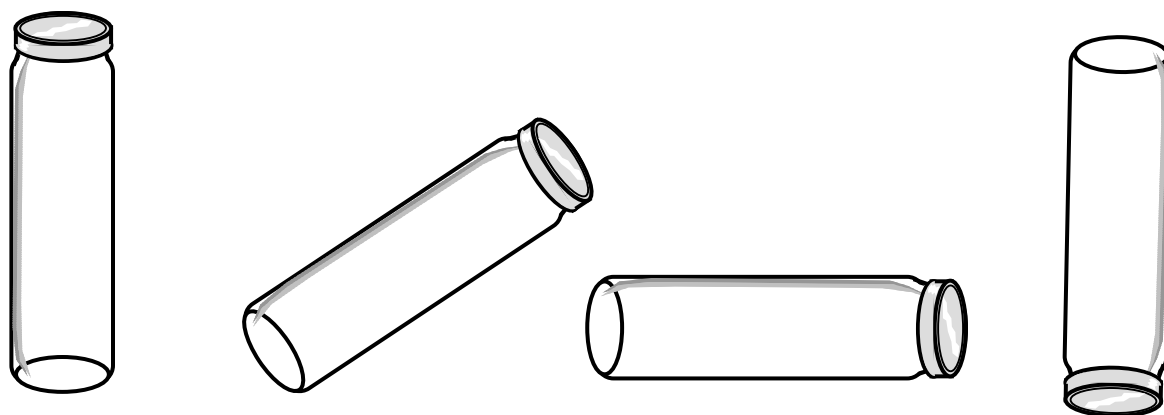
## Station 1: Soft Shapes

Materials: play dough in container, marble, tray

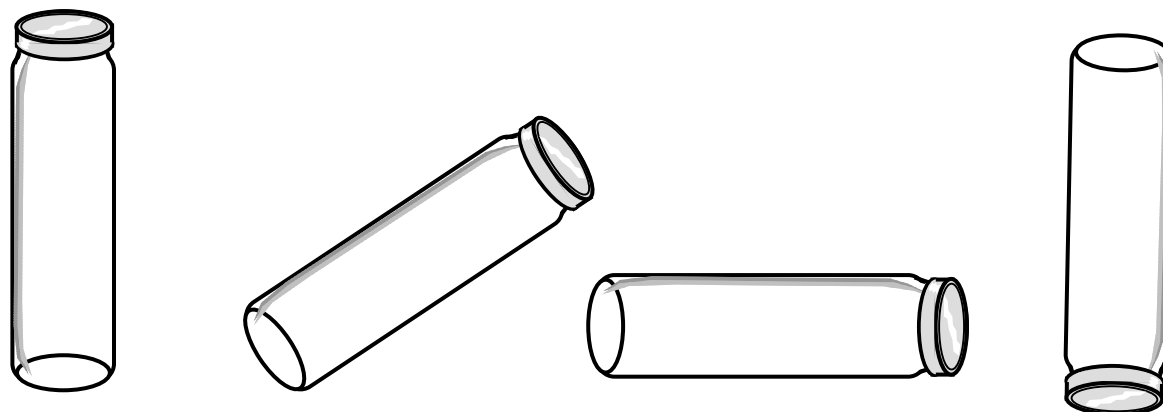
1. Open the play dough container, tip it upside down, and allow the ball of clay to fall into the tray.
2. Did the shape of the clay remain the same when it changed containers?
3. Press on the clay to make it a flat pancake. Does it keep this shape after you stop pressing on it?
4. Place the flattened clay into the container. Tip the container upside down, and allow the clay pancake to fall into the tray. Did it change shape when it changed containers?
6. Why can we press clay into a new shape? What might happen if we try to change the shape of a marble? Try to change the marble's shape, and describe what happens.
7. Which properties of a marble and a ball of clay are alike?
8. Which properties of a marble and a ball of clay are different?

## Station 2: Tip It, Turn It

A. Observe the positions of the bottles below. Predict and draw what each bottle will look like if it is half full of water.



B. After making your predictions, fill a jar half full of water, and observe the bottle in each of the positions shown. Draw how the liquid looks in each bottle position.

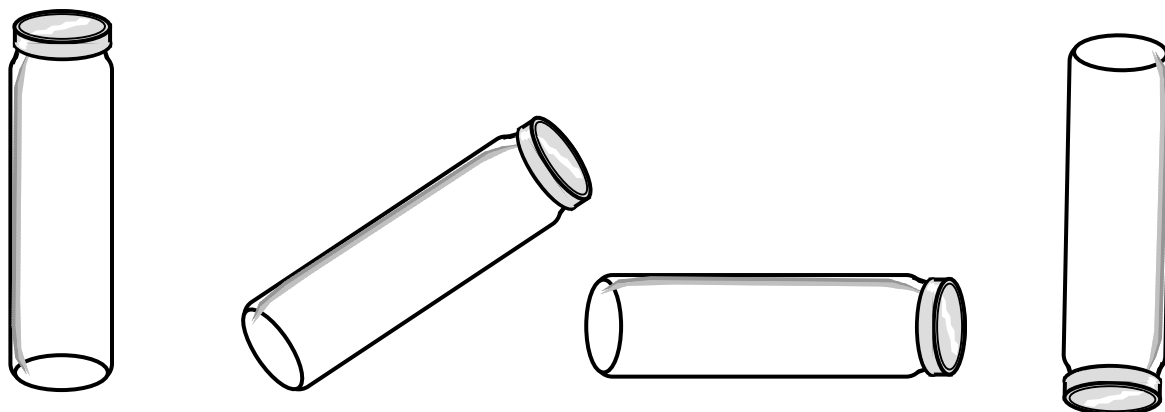


Compare the drawings in Part A and B. Were your predictions correct?

### Station 3: All Bottled Up

Materials: Bottles A, B, C, and D

Observe the materials in the bottles. Tip the bottles in the positions that are shown below.



1. How do the materials move in the bottles when they tip?
2. Roll the bottles. How do the materials move?
3. Shake the bottles. How do the materials move?
4. Do the materials in all of the bottles have some properties that are like water?
5. Do the materials in some of the bottles have different properties than water?

## Station 4: Comparing Sand and Water

Materials: 4 clear plastic cups, sand, water, paper towel, two trays, pennies

### Part A.

1. Fill a cup half full of water, and observe the surface of the water by looking from the side. Is it an even or uneven surface?
2. Place a penny on the surface of the water. What do you observe?
3. Pour a small amount of water on a small piece of paper towel. What do you observe?
4. Pour two small rows of water in the tray. Try to combine the rows to make one row of water. What do you observe?

## Station 4: Comparing Sand and Water

### Part B.

1. Fill a cup half full of sand. Observe the surface of the sand by looking from the side. Is it an even or uneven surface?
2. Place a penny on top of the sand. What do you observe?
3. Pour a small amount of sand on a paper towel. What do you observe?
4. Pour two small rows of sand in the tray. Try to combine the rows to make one row of sand. What do you observe?
5. Based on your observations, which properties do sand and water have in common? What properties are different?



## Station 5: Does Air Take Up Space?

Materials: Envelope, sealed quart-sized plastic bag, flexible straw

1. Place the plastic bag in the envelope. Does it take up space?
2. Remove the plastic bag from the envelope. Open the seal just enough to insert the straw. Using the straw, blow up the bag with air until it is full. Quickly remove the straw, and reseal the bag. Throw the straw away.
3. Try to put the plastic bag back in the envelope. Does it fit?
4. Press gently on the side of the inflated plastic bag. Does air take up space? How do you know?
5. What might happen if the bag bursts or is opened? Open a small part of the seal, and push on the bag until it is flat. Where does the air go?

## Station 6: Can Air Take Up Space in Water?

Materials: Clear plastic cup, paper towel, tape, and clear container of colored water

1. Wad up the paper towel, and attach it to the inside bottom of the cup with a piece of tape. Turn the cup upside down to make sure the paper towel is firmly attached to the inside bottom of the cup.
2. Push the upside down cup straight down into the bucket of water until it rests on the bottom of the bucket.
3. Lift the cup out of the bucket, keeping it upside down and as straight as possible.
4. Turn the cup right side up, and feel the paper towel. Explain the results.
5. Repeat the same steps, but tip the cup sideways while it is under the water before removing it. Turn the cup right side up, and feel the paper towel. Explain the results.



## Station 7: Does Air Have Mass?

Materials: two plastic bags, ruler with string loops threaded through each hole, binder clips



1. Hold up the ruler by suspending it from the string that is threaded through its middle hole.
  - Is it balanced?
  - How do you know?
2. Attach the binder clips to the string loops threaded through holes at each end of the ruler. Attach a plastic bag to each binder clip.
3. Hold up the ruler by the middle string again.
  - Is it still balanced?
  - What does this tell you about the two plastic bags?
4. Take one of the plastic bags off, and use a straw to blow it up. Reseal the plastic bag, and attach it back on the binder clip.
5. Hold up the ruler by the middle string again.
  - Is it still balanced?
  - What does this tell you about the balloon filled with air?
9. Is there another way to test or measure to find out if air has mass? Explain how you would do it in the space below.

# States of Matter

## Property Cards

Flows when poured
Shape does not change when it is moved
Piles up when poured
Spreads out when poured
Has mass

Holds the shape it is given
Spreads out and fills all of the space in any container
Has a flat, level surface when poured
Has mass
Supports objects that are stacked or placed on it

# States of Matter

## Property Cards

Flows and  
spreads to fill  
a container

Has no shape of  
its own

Can be squeezed  
into a very small  
space

May roll, slide, or  
stack

Takes up space in  
an open container

Holds the shape  
it is given until it  
is molded into a  
new shape

Spreads out and  
fills all of the  
space in any  
container

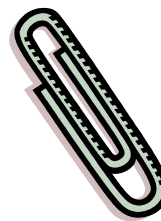
Has no shape of  
its own

Has  
mass

Takes up space in  
an open container

## Station 1

### The Flying Paperclip



1. Observe the paperclip.
2. What could cause a paperclip to fly in the air?
3. Pass a 3x5 index card between the arm of the balance and paper clip. Is anything holding them together?
4. Blow on the paperclip. Does the paperclip move?
5. Report your observations in your journal, using words and pictures.

## Station 2

### Stick To It!

Materials: plastic bag, penny, iron filings sealed in a petri dish, paper clip, safety pin, iron nail, aluminum foil, brass tack, twist tie, twig, rubber band, toothpick, tray, magnet

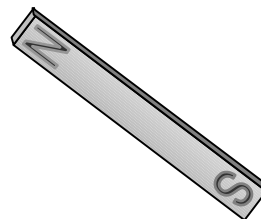
1. Place the items in the baggie on the tray.
2. Predict which items might stick to the magnet, and record in the chart.
3. Test each item, and record if it did or did not stick to the magnet.
4. Place objects that stick to the magnet outside the tray. Are these objects alike in any way?
5. Leave objects that do not stick to the magnet inside the tray. Are these objects alike in any way?
6. After testing all of the items, compare your predictions to the results of your tests. Were any of the results different from your predictions?
7. Circle your predictions that were different than the test results. (Remember that a prediction states what might happen in a test, and can be revised.) Are the circled objects alike in any way?

## Stick To It! Data Sheet

1. Predict which objects will stick to magnets, and record by circling Yes or No under the Predict column.
2. Test each object, and record by circling Yes or No under the correct column.

Object	Predict: Will it Stick?	Sticks to the Magnet	Doesn't Stick to the Magnet
Safety pin	yes or no	yes or no	yes or no
Copper Penny	yes or no	yes or no	yes or no
Nail	yes or no	yes or no	yes or no
Twig	yes or no	yes or no	yes or no
Aluminum Foil	yes or no	yes or no	yes or no
Rubber Band	yes or no	yes or no	yes or no
Paper Clip	yes or no	yes or no	yes or no
Iron Filings	yes or no	yes or no	yes or no
Brass Tack	yes or no	yes or no	yes or no
Toothpick	yes or no	yes or no	yes or no
Twist tie	yes or no	yes or no	yes or no

### Station 3 Push or Pull?



Materials: Bar magnets, ring magnets and holder

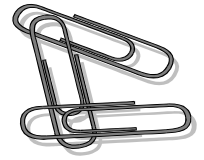
#### A. Bar Magnets

1. Place the ends of the bar magnet marked N close to each other. Record the results in your journal.
2. Place the ends of the bar magnet marked S close to each other. Record the results in your journal.
3. Place an end of the bar magnet marked N near an end marked S. Record the results in your journal.

#### B. Ring Magnets

1. Observe the four circular ring magnets. Do they have any markings?
2. Pull the red ring magnet away from the others. How does it feel?
3. Predict what might happen if the red ring is turned over before it is replaced next to the other magnets. Test your prediction. Describe how the magnet behaves.
4. Slide the ring magnets on the black holder so they all stick together.
5. Slide the ring magnets on the black holder so that they do not stick together.
6. Record the results in your journal.
7. Based on your tests, compare the properties of bar and ring magnets.

## Station 4: Pick Up Clips

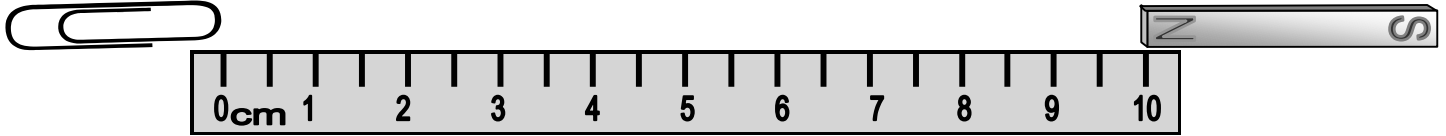


Materials: Bar magnets, masking tape, bowl, paperclips, cm ruler

1. Measure the bar magnet in centimeters. Find the middle of the magnet, and mark it with masking tape.
2. Put the paperclips in the bowl.
3. Prepare a chart in your journal to record how many paper clips are picked up by the ends and the middle of your bar magnet in three trials.
4. Place the bar magnet horizontally over the bowl of paperclips, then pick it up carefully.
5. Count the number of paper clips that are attached to each end and the middle of the bar magnet. Record the results in your chart.
6. Which parts of the magnet seem the strongest?
7. Which parts of the magnet seem the weakest?



## Station 5: Which Magnet is the Strongest?



Materials: paper clip, centimeter ruler, small bar magnet, large bar magnet, cylinder magnet

Predict which magnet is the strongest, and record it in the chart. Follow these steps to test the magnets:

1. Place the end of the paper clip at the zero mark of the ruler.
2. Place the small bar magnet at the 10 cm mark on the ruler.
3. Slowly slide the magnet toward the paperclip until it attracts the paper clip. Record how many centimeters the magnet is from the paperclip when it attracts the paperclip, to the nearest centimeter.

Magnet	Distance from Paperclip
Ring Magnet	cm
Bar Magnet	cm
Cylinder Magnet	cm

Which magnet is the strongest?

What could you do to make the magnet test more reliable?

Design another test to find out which magnet is strongest. Record the test and the results in your journal.

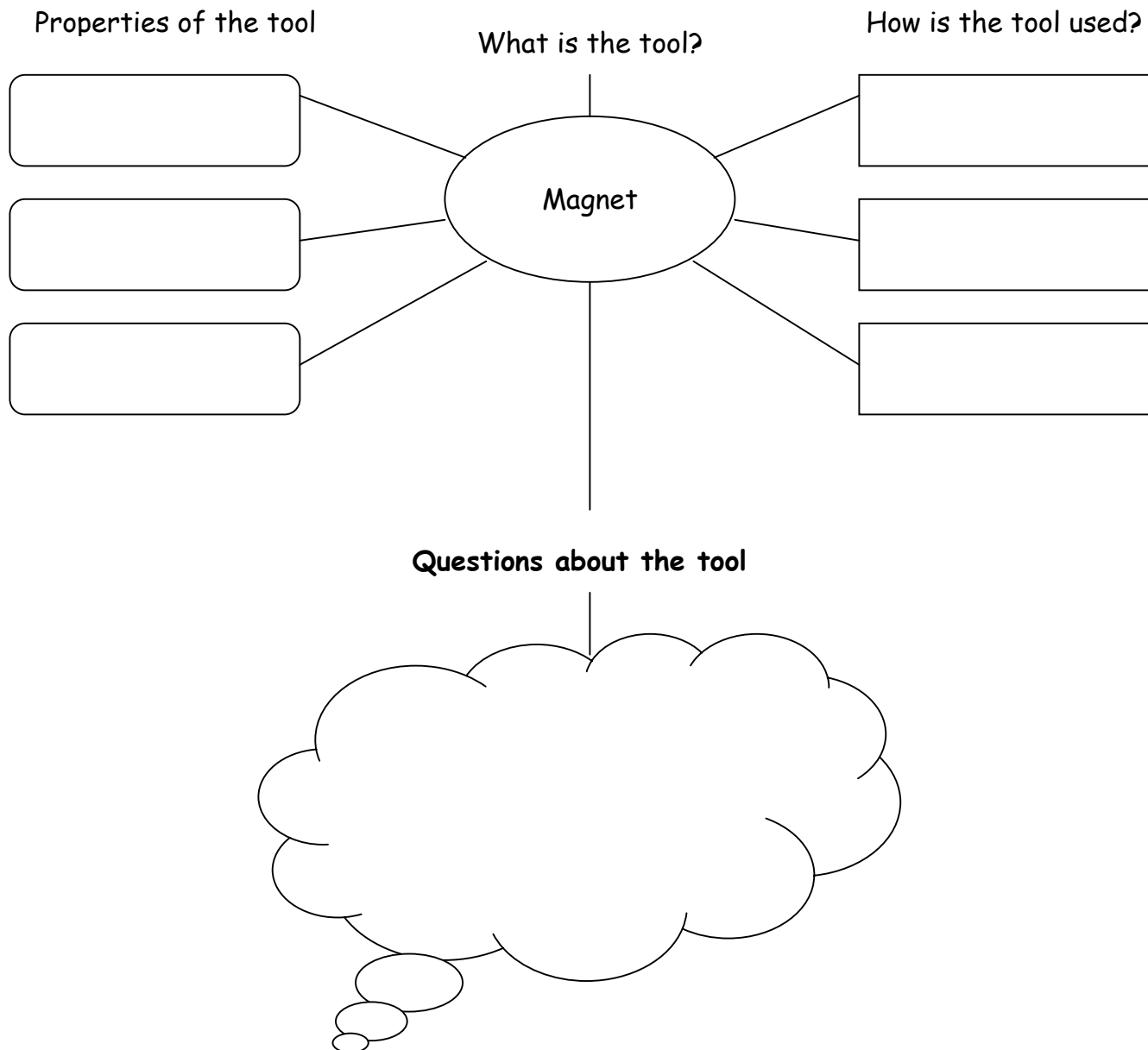
## Station 6: The Special Rock

Materials: Magnetite, baggie, toothpick, paper clip, penny, iron nail

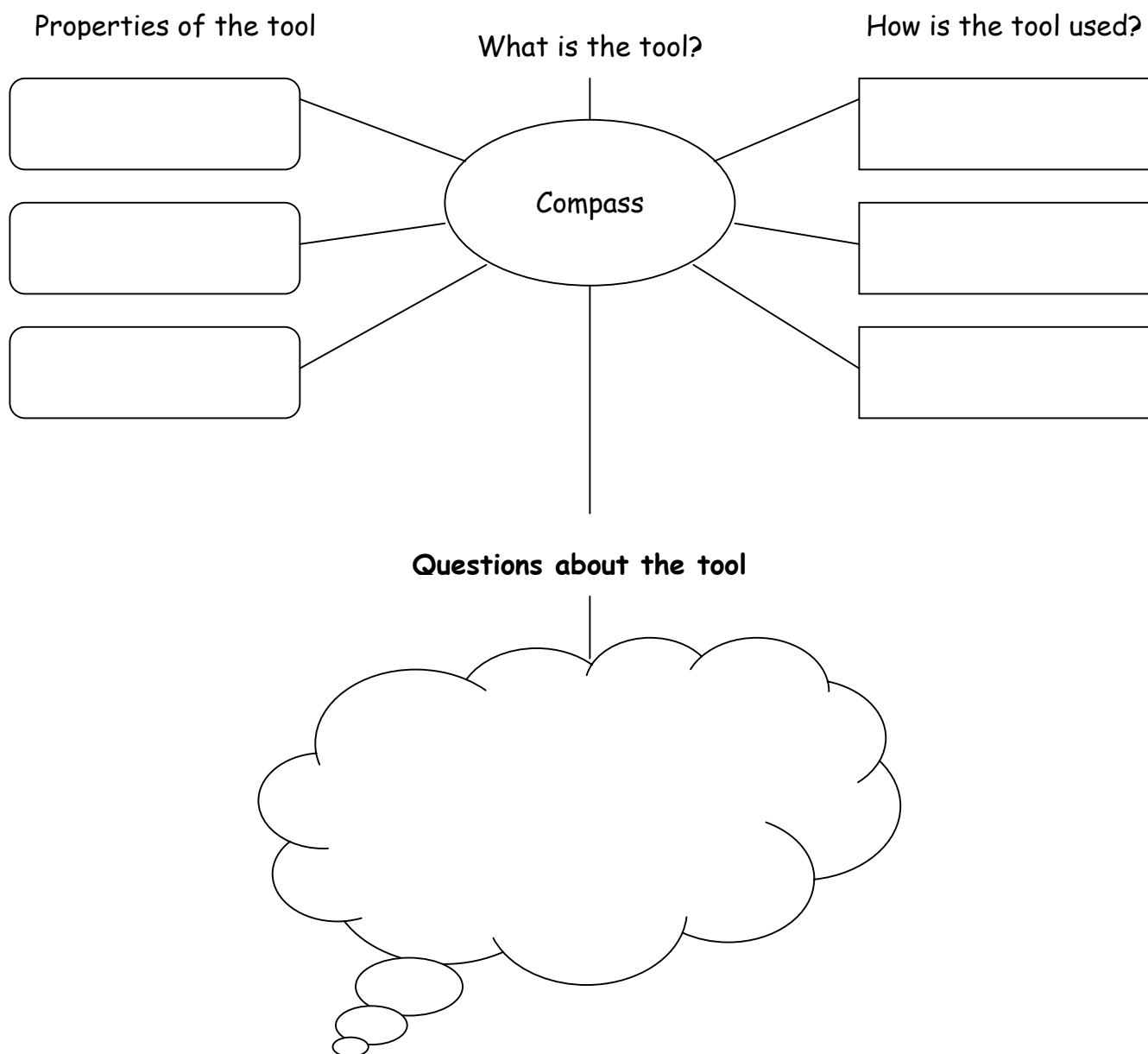
1. Pick up the rock, and observe it carefully. What are its properties?
2. How could you test the rock to find out if it has other properties?
3. Using the materials in the plastic bag, design and perform a test on the rock.
4. Record your test and observations in your science journal.

Name: \_\_\_\_\_

## TOOL CONCEPT MAP



# TOOL CONCEPT MAP



## Matter and Magnetism Assessment

1. A student discovered that when he placed two bar magnets ends close to each other, they pulled toward each other with a strong force. Which diagram below shows how the student placed the magnets? Bubble the letter of the correct choice.

- ☐ A      
- ☐ B      
- ☐ C      

2. A student placed a strong magnet near a penny, an iron nail, a brass tack, a steel wire, and an aluminum can.

Did the magnet attract any of these objects? \_\_\_\_\_

If so, which objects were attracted to the magnet?

\_\_\_\_\_

3. A student wanted to pick up as many paper clips as possible during his turn of the magnet relay race. His bar magnet was wider than the bowl of paper clips, so he placed the center of his bar magnet over the bowl. Did this student pick up more paperclips than a student who placed the end of her magnet over the bowl of paper clips? Explain your answer.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

4. A student tests a material to find out about its properties. The result of one of the tests is pictured below. What properties did the student discover about the material? What other tests could be done to find out more properties of the material?

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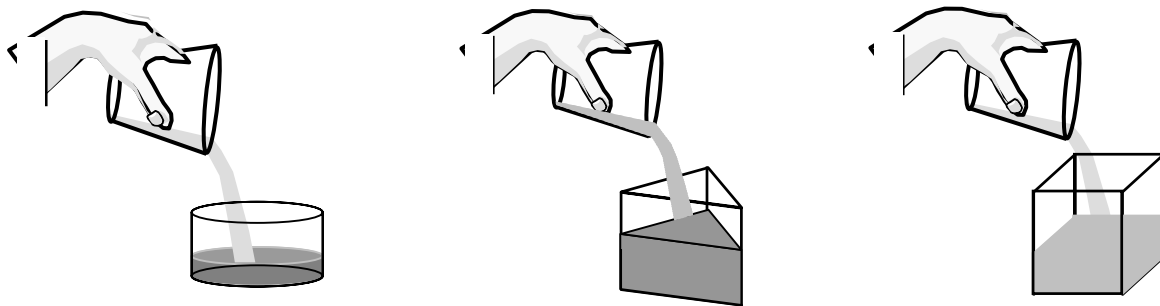
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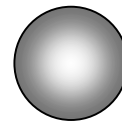
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1. Explain which properties of a material you could discover by using the tests shown below.



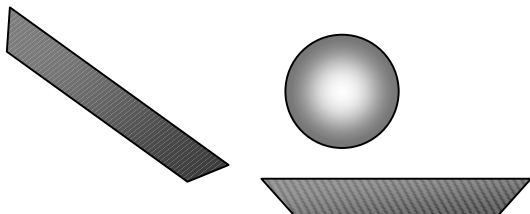
Test One: Roll the material into a round ball.

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Test Two: Place the ball on a balance.

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Test Three: Pour the ball from one pan to another pan.




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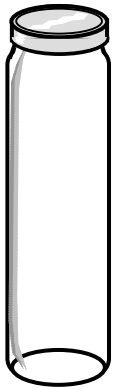
# Matter and Magnetism

## Performance Assessment

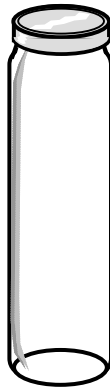
Materials: 3 plastic jars, bar magnet, sand, 3 paper clips, water

Find a way to remove the paper clip from the jar of sand, water, and air without touching the paperclip or putting the magnet in the jars.

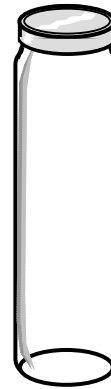
Draw your plan on each jar picture, showing how you will use the magnet.



Sand



Water



Air

Write the results of your tests below.

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I conclude that magnets can attract paper clips

through \_\_\_\_\_ because

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# Matter and Magnetism

## Scoring Rubric

Task	Criteria	
1. Properties of Magnets	Demonstrates understanding that: magnets attract metal objects that contain iron, magnets have two poles, magnetic force is stronger at the poles than in the center, like poles repel while opposite poles attract.	4
	Demonstrates understanding of most magnetic properties, with one omission.	3
	Demonstrates understanding of some magnetic properties, with two omissions.	2
	Demonstrates understanding of few magnetic properties, with three omissions.	1
	Demonstrates understanding of very few magnetic properties, with four omissions.	0
2. Properties of Matter	Demonstrates understanding that: Matter has mass and takes up space. Matter exists in 3 states: (1) Solids maintain their shape when moved into different containers, and take up a definite space; (2) Liquids flow when poured, and take the shape of their containers; (3) Gases have no shape and spread out to completely fill any container.	4
	Demonstrates understanding of most properties of matter, with one omission.	3
	Demonstrates understanding of some properties of matter, with two omissions.	2
	Demonstrates understanding of few properties of matter, with three omissions.	1
	Demonstrates understanding of very few properties of matter, with four omissions.	0
3. Matter and Magnetism Performance Assessment	Solves the problem, and clearly communicates the solution in words and pictures. Demonstrates and communicates deep understanding of the properties of matter in solid, liquid, and gas forms, and properties of polarity by using ends of magnet to attract the paper clip.	4
	Solves the problem, and communicates the solution in words and pictures. Demonstrates and communicates a basic understanding of the properties of matter in solid, liquid, and gas forms, and properties of polarity by using ends of magnet to attract the paper clip.	3
	Solves the problem, and communicates the solution in words and pictures. Demonstrates and communicates misconceptions about the properties of matter in solid, liquid, and gas forms, and properties of polarity by using the middle of the magnet to attract the paper clip.	2
	Makes an attempt to solve problem, but the solution is incomplete. Needs more experiences to understand properties of matter and magnetism.	1
	Does not attempt to solve problem.	0



## Lab Skills, Safety and Journaling

Task	Criteria	
3. Lab Skills, Safety, and Participation	Selects and uses appropriate equipment with care and proficiency. Handles magnets and compass with great care. Listens attentively, and stays actively involved in each activity.	4
	Uncertain about equipment selection, but uses equipment carefully. Handles magnets and compass with care. Listens to instructions and stays involved, but may wait for others to lead.	3
	Is not familiar with use of equipment, so often makes inappropriate choices, but does not abuse equipment. Handles magnets with care, with reminders. Distracted during instructions, so must rely on others for directions.	2
	Uses equipment improperly, and is haphazard and disorganized. Needs to review rules for safe handling of magnets. Is distracted during instructions, and needs constant reminders to stay on task.	1
	Does not use equipment or abuses equipment. Handles magnets carelessly. Is disruptive during instructions and activity.	0
4. Matter and Magnetism Science Journal	Contains very detailed entries and labeled drawings that clearly communicate each learning experience, no omissions. Makes relevant inferences and connections with matter and magnetism concepts. Very neat and well organized.	4
	Contains detailed entries and labeled drawings that communicate each learning experience, with one omission. Asks relevant questions, and makes inferences and connections with matter and magnetism concepts. Neat and organized.	3
	Contains fairly detailed entries and drawings, with two omissions. Asks questions, and makes some inferences and connections with matter. Neat, but may need to spend more time organizing entries.	2
	Contains some entries and drawings, with three omissions. Asks few questions, and makes few inferences and connections with matter concepts. May need to spend more time on neatness and organizing entries.	1
	Contains minimal entries and drawings, with four or more omissions. Makes no inferences or connections with optical systems concepts. Needs to spend more time on neatness and organizing entries.	0